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Land Clearance
and Utilisation

WORLD CROPS

The International Journal of Agriculture

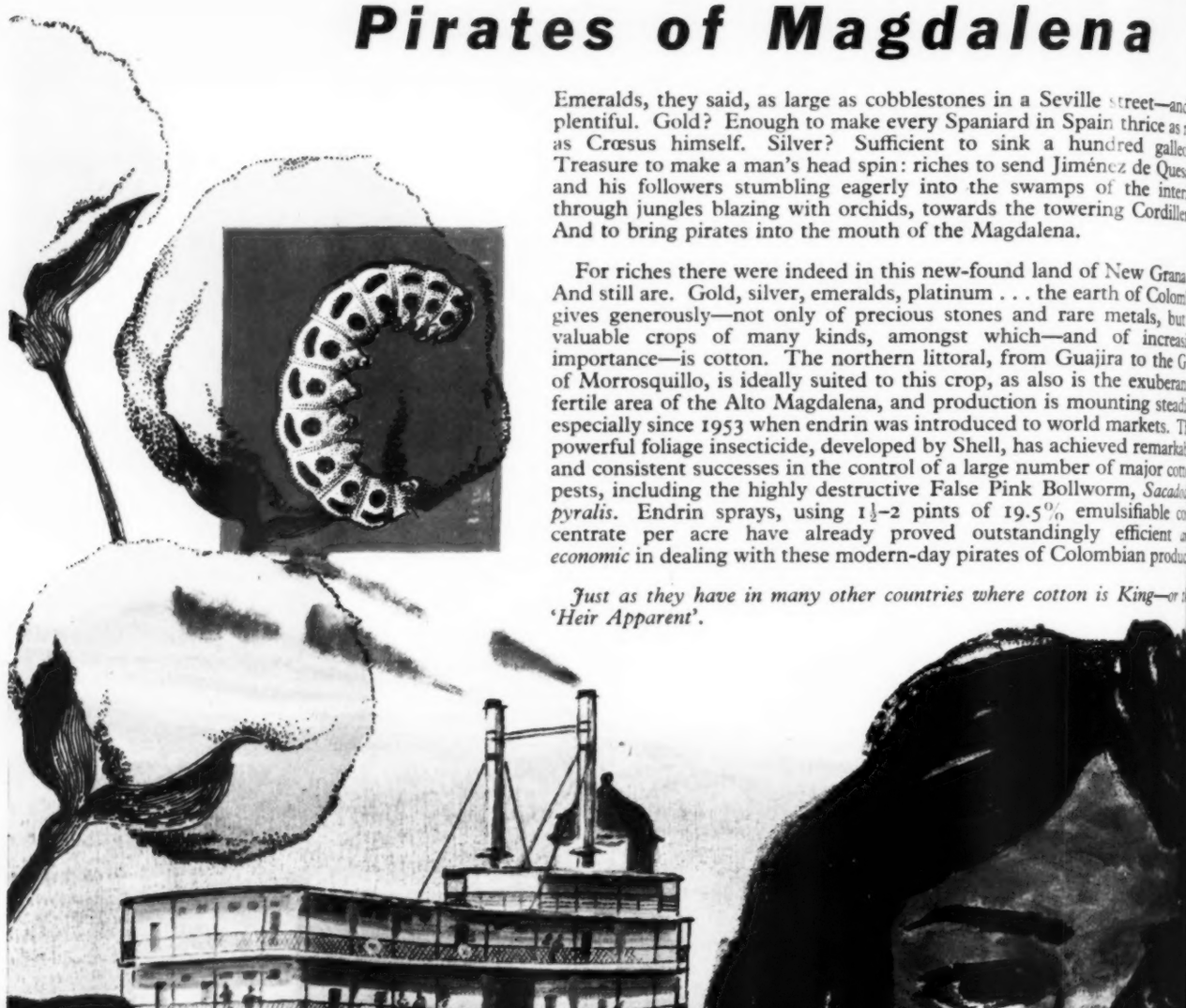
UNIVERSITY OF MICHIGAN
APR 8 1958
FORESTRY LIBR

VOLUME 10, No. 4 APRIL 1958

A Publication of The Leonard Hill Technical Group

Caterpillar D4 Diesel Tractor pulling a gang of Towner spring tooth harrows

Pirates of Magdalena



Emeralds, they said, as large as cobblestones in a Seville street—and a plentiful. Gold? Enough to make every Spaniard in Spain thrice as ric as Crœsus himself. Silver? Sufficient to sink a hundred galleon Treasure to make a man's head spin: riches to send Jiménez de Quesad and his followers stumbling eagerly into the swamps of the interio through jungles blazing with orchids, towards the towering Cordillera And to bring pirates into the mouth of the Magdalena.

For riches there were indeed in this new-found land of New Granad And still are. Gold, silver, emeralds, platinum . . . the earth of Colombi gives generously—not only of precious stones and rare metals, but o valuable crops of many kinds, amongst which—and of increasin importance—is cotton. The northern littoral, from Guajira to the Gu of Morrosquillo, is ideally suited to this crop, as also is the exuberant fertile area of the Alto Magdalena, and production is mounting steadily especially since 1953 when endrin was introduced to world markets. Th powerful foliage insecticide, developed by Shell, has achieved remarkabl and consistent successes in the control of a large number of major cotto pests, including the highly destructive False Pink Bollworm, *Sacadod pyralis*. Endrin sprays, using 1½–2 pints of 19.5% emulsifiable con centrate per acre have already proved outstandingly efficient an *economic* in dealing with these modern-day pirates of Colombian produc

Just as they have in many other countries where cotton is King—or t 'Heir Apparent'.

Shell endrin

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Editorial Comment

The three wise men

THREE REPORTS* which have recently appeared have an important bearing on the future trend of trade in agricultural chemicals and agricultural machinery. Firstly OEEC has just published its fourth report, covering 1956 and the first half of 1957, with the title ' The Chemical Industry in Europe ', then the report entitled 'Britain and Europe ', published by the Economist, and finally there is the report of the Three Wise Men - the so-called Cohen report.

In view of the information that is contained in these reports, it is indeed not surprising that the Association of British Chemical Manufacturers expressed itself in favour of participation in the European Free Trade Area. On balance the chemical industry will gain from taking part in a wider and a freer market, but the impression can be gathered that a new period of intense effort is at hand for both the agricultural chemical and the agricultural engineering industries, both of which have already shown such spectacular and splendid progress since the war.

Changing economic conditions not only in the European market, but also in the Middle East, the Far East and in the far Pacific will necessitate a complete reassessment of his position by each individual manufacturer. Now is not the time to stand still and wait for business to come in, or merely to be content with advertising on the old lines. An entirely new concept is required. THAT IS WHY THE CROP PROTECTION AND PEST CONTROL EXHIBITION IS SO REMARKABLY WELL-TIMED. Every exhibitor will be able to meet the representatives of 61 nations and visitors who will be coming from 107 countries. This exhibition, the first of its kind, will present an unrivalled opportunity to take advantage of the vast and expanding overseas market. There are signs that a period of recession is on us. No one can afford to play safe. The progressive will lay the seeds for future prosperity. In good times it pays to be cautious; a period of depression, be it long or only of short duration, is the time to be optimistic, to invest and to build for the future. It is in the underdeveloped countries of Europe, in the Middle East and in the Far East that the greatest opportunities lie. They urgently need help, but the manufactured products of western industry must also be made available at prices which are commensurate with the price of primary products, which have fallen by 12% in the last 12 months.

Here is a true story of business optimism that paid off in the unforgettable slump of the thirties. In 1931, the Hawaiian pineapple industry packed some 300 million tins of canned pineapple, then worth about U.S. $20 million. Unfortunately this was the year of world-wide economic collapse, when the whole price structure broke down. Even so, the vast sum of U.S. $1,500,000 was spent on advertising and demonstration, the enormous accumulation of packed stock was cleared and thereafter production was again resumed on a steadily-expanding scale.

A.D. 2000?

AT THE Eugenics Society early this year Dr. G. C. L. Bertram, the General Secretary, stated that world population was growing at an unprecedented and accelerating rate. The present total of 2,700 million will double within the lifetime of many already in secondary schools, since, according to his estimate, world population in A.D. 2000 will exceed the 4,000-million mark (see page 123).

When the Rev. T. R. Malthus, an English clergyman, published *An Essay on the Principle of Population* in 1798 the world population was then only about 900 million. Even at this time most people were under-nourished and the basic premise of Malthus was that all species of plants and animals tend to increase faster than their means of subsistence. This conclusion was in the nature of a protest against Man's ineptitude to fit in with his surroundings, for then there was still plenty of room in the world, since the Americas, Australasia, South Africa, East Asia and Siberia were at that time but sparsely occupied. When Malthus wrote, food shortage was the result of poor communications and the uneven distribution of mankind over the earth, and was not due to lack of cultivable land.

Of today's population, now three times as great as in 1800, two-thirds are under-nourished, and even if the yield from the cultivated land could be increased by 50% there would still be insufficient food to provide a satisfactory diet for all. In fact, it is considered that, at most, present yields can only be raised by 30%.

Whenever the depressing facts relating to the world's food supply are raised, the subject is often shrugged off with such comforting statements as ' Something will turn up ' or ' Man will adapt himself to conditions '. Thus there are at present 2,400 million acres of land, good, bad and indifferent, under cultivation, almost 1 acre per head of the present world population. In Japan intensive cultivation and heavy doses of 'artificials' produce such high yields that a poorish, yet adequate diet of about 2,000 calories per day is won from one-fifth of an acre per head of the population. This is augmented by proteins from the over-fished surrounding seas and by imports of food paid for with

*1. ' Britain and Europe '. The Economist Intelligence Unit, 1957, 15s.
2. ' The Chemical Industry in Europe ', H.M.S.O., 1957, 18s.
3. 'Council on Prices, Productivity and Incomes ', H.M.S.O., 1958, 2s.

manufactured goods exported to countries which are generally striving to industrialise themselves. In 1937, the population of little Japan was 70 million; in 1967, it will probably be 105 million. Does anyone imagine that a virile race like the Japanese will slave away in hunger with the Asiatic mainland just over the horizon? No comfort can be drawn from such a desperate situation.

The population of the U.S.A. is 170 million and is increasing at the present rate of $3\frac{1}{2}$ million per annum. The out-turn per acre in the U.S.A. is low and $3\frac{1}{2}$ acres of land are under cultivation per head of the population to maintain the very high standard of living of that country. By the turn of the century, however, the population will be around the 300-million mark and either the living standard will need lowering or food will have to be imported from other countries, many of which cannot feed themselves adequately.

The populations of India and China are also rising rapidly, in spite of the fact that the people in these badly-farmed areas are markedly under-fed. Even with the agricultural improvements now in hand, crop increases can barely keep pace with the arrival of millions of extra mouths to feed.

Western Europe is better farmed than most areas in the world and the standard of living is high, but, in spite of the fact that emigration to the newer countries proceeds briskly, the home population is still rising rapidly. In due course Europe will look to the East for expansion and for food, and no doubt the East is fully aware of this inevitable possibility.

Great Britain is, we consider, the best-farmed country in the West, easily the most highly mechanised and making the biggest out-turns per acre. Yet she produces only enough food for 60% of her people and pays for the imported balance in goods exported to markets which become increasingly more difficult.

The optimist may point to South America, where vast areas still remain untouched by the plough. This is certainly true, for the population of the whole continent is only 120 million, but by the end of the century it will be well over 200 million. But industrialisation and self-sufficiency are the watchwords of the Latin states today. It is a chastening thought that the Argentine now exports only $13\frac{1}{2}$% of its beef and consumes the rest in the country.

Realists are fully aware of the limits of world resources, which, at the present rate of population increase, will soon be inadequate even for subsistence standards. The situation mankind is approaching may be met, temporarily, by a reduction in the standard of living or, permanently, by birth control. Anyone who knows conditions in China or India understands how difficult the latter will be in either of those areas. The peoples of the U.S.A. and Western Europe, who are fully aware of these things, are, however, also multiplying very rapidly and who can possibly stop them?

There is a third alternative, which at present seems inevitable, and that is a struggle for *lebensraum*, in which only the strongest and most intelligent will persist. Nature's brutal law of the survival of the fittest is perhaps the only one which can apply in a world of hungry men. Perhaps those alone who will not live to see the end of this century can treat the matter with continued and studied indifference.

Change or decay?

Change and decay in all around I see . . .—'Abide With Me'
H. F. Lyte, 1793-1847

CHANGE OR decay is the choice that confronts every country in the world of today—all nations, great or small, advanced or backward, long established or newly self-governing. The clock cannot be put back. We must be prepared to change with the times, or else decay and perish, even as the collapse of Roman civilisation was followed by the Dark Age in Europe, a condition which lasted some hundreds of years.

The need for resilience and the ability to face new situations and recurring crises make it necessary for the leaders of today to be young enough in spirit to move with the times and readjust their ideas with every fresh change in the kaleidoscopic pattern of world affairs. Nothing is more certain than that we cannot put the clock back. And what applies to politics is also true for the changing pattern of world trade.

The recent revolutionary change in Indonesia is a case in point. It cannot be denied that the Dutch colonists who went to Java and the surrounding islands have done splendid work in improving health conditions, developing road, rail and air communications and in research in the field of tropical agriculture. The former Netherlands East Indies had once the largest acreage under coconuts in the world, they were the pioneers of bud-grafting and the production of high-yielding clones of rubber, they were the largest exporters of tapioca in the world, and Dutch cigars were world-famous.

It was but natural and inevitable that with the remorseless increase in population (now well over 80 million), and as a direct result of education, the native-born people of the Netherlands East Indies would ultimately demand the right to self-government, as has occurred elsewhere. The latest development (full economic independence) is economic in origin and mainly the result of an acute foreign exchange crisis – the value of their exports of primary commodities was less than the value of the imports of consumer goods, and the gap was widening. This problem is not one which is facing Indonesia alone, but all countries whose economy is based on the production of primary commodities, such as tea, rubber, copra, wheat, maize, tapioca, tobacco etc., and whose rising standards of living demand the increasing importation of consumer goods, such as medicines and pharmaceuticals, bicycles

and motor cars, radios and movie films, patent and canned foods etc. (see Report to the FAO Council, *The State of Food and Agriculture*, 1957, page 5, retail food prices).

Political changes tend to be premature and economic changes bring hardship and the dislocation of trade and, in consequence, these changes are understandably condemned. There is little doubt that, in almost all cases, independence is achieved before the people *as a whole* are ready for it. The new government takes over a sound administrative machine, but is unable to keep it working smoothly.

We may disagree; we may say we told you so; but we cannot put the clock back. We can, however, give aid, guidance and advice, not altruistically, but for mutual benefit. Above all, we can ensure that the forces of destruction do not gain the upper hand. It has rightly been said that Communism flourishes on misery and despair, and those who have been indoctrinated with these perverted ideals are really convinced that the perfect form of government can only be achieved by bloody revolution and by a complete reversal of the framework of society, whereby the most intelligent are ruled by the least intelligent. In 40 years Russia has not achieved either stability or the perfect form of government. They may have invented the Sputnik, but there is still not a decent motorable road between Warsaw and Moscow and the life of the common man is drab and drear.

A very informative article, ' Indonesia in Perspective ', in the January issue of the *Eastern World* suggests that the reason for President Sukarno's protracted restcure abroad was to allow moderate elements under Dr. Hatta to bring about a reversal of the policies set in motion a short time ago. If this is true, it is a most hopeful sign, for an economic climate is being created in which it is possible to do business again and for substantial assistance to be given in much the same way as Potascheme Co. of Madras, is assisting the more effective production of rice, coconuts and tapioca in India (see WORLD CROPS, 1957, **9**, 379).

The proposal we have to put forward is the creation of a second East India Company,* consisting of manufacturers of agricultural machinery, agricultural chemicals, farm equipment and seeds and supplies to improve the productive efficiency of the primary industries, not only of Indonesia, but also of other countries who are prepared to give the necessary guarantees of political stability in return for some form of long-term credits which will enable these countries to balance their economies. One important requirement, however, will be a halt to the policy of inflation in Western countries, which is leading to rising wages and rising prices for retail goods, while world prices for primary products are falling. The choice is therefore clear – change or decay.

* The ' Governor and Company of Merchants of London ' was founded by Queen Elizabeth I on 31 December, 1600, and lasted until 1858.

The great flood

. . . and the rain was upon the earth forty days and forty nights; and the waters increased and bare up the ark, and it was lift above the earth . . . and the waters prevailed upon the earth an hundred and fifty days.—Genesis VII.

THE RECENT island-wide floods in Ceylon were, we are reliably informed, due to heavy rains, but this is not unusual for the tropics. On two days, there were falls of 15 and 30 in., and it also rained continuously for several days over an extensive area. The saturated earth could hold no more and there were many serious landslides and the surface waters from the central massif poured down into the valleys and inundated the coastal plain with disastrous consequences to life and property.

Floods are a regular occurrence in this country, but this was the worst within living memory. Each year there have been leaders in the Press about the need for something to be done about it, but nothing is ever done until a disaster, such as this, brings home the awful consequences of the sustained neglect of soil and water conservation principles. The obvious lesson of the disaster is that the flood defences are inadequate.

The disaster may also provide the explanation why the vast irrigation works of ancient times fell into disrepair and the surrounding country, once the site of a former civilisation, is now abandoned and overgrown with jungle. This has occurred in other countries also. There are literally hundreds of breached ' tanks ' (water reservoirs) to be found deep in the jungle, far from populated areas, in all parts of Ceylon – particularly in the Southern Province. The evidence today clearly points to the fact that the tanks which have been breached, such as the Giant's Tank at Mannar in the north, had become too shallow to accept an unusually heavy rush of water.

In ancient times, tanks, so breached, were obviously never repaired because they were not worth repairing. It would have been an impossible task to de-silt these vast areas, some nearly 100 sq. miles in extent, by manual labour, using baskets and handtools. In recent times, the dams have been repeatedly raised by earthing-up – an expedient of doubtful value. It has been suggested that this practice was the cause of the downfall of Sumer in Mesopotamia (Iraq) at the dawn of history.

The three principal factors contributing to the disaster were the heavy and continuous rain and the extensive area, so affected; the almost immediate runoff of surface water, not only in the mountain areas, but also in the more extensive lowland areas; and the inability of the floodwaters to escape from the valleys to the sea.

Floods, of course, begin in the small watersheds in the hills; the abandonment of ' chena ' lands, cleared under the system of shifting cultivation, the over-rapid clearing of jungle areas, which exceeded the rate of colonisation, and the change in ownership of formerly

well-maintained tea estates, and the almost total neglect of elementary soil and water conservation measures on the low-country coconut and rubber estates are in our opinion the chief causes of the rapid run-off.

For some time now, ugly scars on steep hillsides have indicated a change in the ownership of a tea estate – the new owner has been content merely to pluck his property to destruction at the lowest possible cost to himself. Gradually the tea bushes become fewer and more stunted, and finally scrubby vegetation covers the land and the former lovely estate is a total loss, not only to the owner, but also to the national economy, for where has the valuable topsoil gone? Down into the valleys, literally in millions of tons.

As a result of all these faulty practices in recent years the tanks have all silted up and had, in fact, little holding capacity, the rivers have imperceptibly become more shallow and tortuous, and the lagoons at their mouths have silted-up and become choked with Salvinia and other weeds. In some places, too, the outlet to the sea was deliberately not kept open in order to raise the level of water, so as to preserve the fishing in the lagoon, and this to the serious detriment of the surrounding agricultural lands.

What is the moral of all this? It is that you can't do agriculture on the cheap. This is why small-scale farming and the fragmentation of agricultural lands is the antithesis of a sound agricultural economy – subsistence agriculture is fatal where populations are increasing as rapidly as in Ceylon.

Now to be constructive. What is to be done? Obviously aid on a massive scale will be required. A plan for each individual watershed needs to be drawn up. Every essential tank will need to be desilted and many feet of earth removed. What was impossible with baskets on the head, is now feasible with modern earth-moving machinery and wet dredging equipment. The rivers, too, will need to be straightened at certain strategic points, the lagoons will need to be dredged to maintain a straight channel through to the sea, free of all weeds and sandbanks, and above all no sandbars must be allowed to form at the exit to the sea.

A correspondent has informed us that the U.S.A. is going to develop the Mahaveli and that the U.S.S.R. is to develop the Kelani. *This is good news so long as such aid does not become a part of the serious cold war.* Ceylon, too, will need to strengthen the hands of the Forestry and of the Soil Conservation Departments, even at the expense of social welfare developments. Much more money will need to be allotted to afforestation, particularly in up-country areas and the silt content of all streams and rivers will need to be watched so that faulty conservation practices can be traced back to their source.

This disaster has, we read, shocked the nation out of political emotionalism into a sense of reality and has given a divided people a sense of unity of purpose. ' Sweet are the uses of adversity ' says Shakespeare.

Antarctic adventure

WHEN WE were very young we once asked Dr. G. I. Finch, the scientific officer of a former Everest expedition led by Major-General Bruce, why they were going to try to climb this great mountain. The answer not only surprised us, but has remained with us as an inspiration ever since. It was, he said, more to keep alive the spirit of adventure than for the advancement of scientific knowledge.

We were reminded of this during the so-called race to the South Pole between Fuchs and Hillary, which in actual fact was not a race at all. The Director of the Royal Geographical Society, Mr L. P. Kirwan, in a recent BBC broadcast has since explained the real purpose of the expedition.

One object of this great land journey, he said, was to make a seismic traverse across the whole continent and to ascertain the thickness of the Ice Cap. This was being done by detonating explosive charges and measuring the echo from the underlying rock at intervals along the journey. The idea was to determine the total volume of ice covering the continent.

The study of the shrinkage of the Ice Cap and the recession of glaciers is one of the important studies being undertaken during the geophysical year. We ourselves have seen the extensive recession that has taken place in recent years in the Franz Joseph glacier in New Zealand, and the same is happening in the case of all other glaciers and in the Polar regions – simply the ice is melting away. This, Mr. Kirwan suggested, may be due to the warming up of the world's climate. He went on to say that if the rate of melting were greatly to increase it would have some dramatic consequences. If all the ice on the Ice Caps were to melt, the level of the sea all over the world would rise some 200 ft. There is no need to enlarge on what this would mean to the agricultural lands of the world and to important cities, such as New York, London, Paris, not to mention Singapore, Shanghai and Colombo. There is also, of course, no need for immediate alarm.

The suggestion is, however, not as fanciful as it may seem, since during the Great Ice Age the Polar Ice Cap extended right down over most of England and Wales. In the teachings of the great Buddha we learn that the universe develops and recedes according to the breathing in and breathing out of the Buddha. Perhaps this conception can now be explained by a periodicity of the climate of the universe over the aeons of time.

Living weedkiller

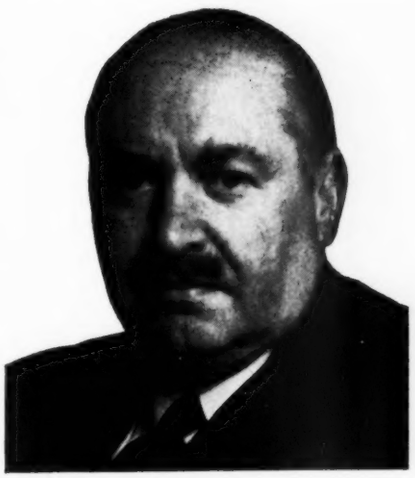
WE LEARN that experiments have been conducted in Kenya with a new selective weedkiller – the domestic pig. Pigs have been used there in crops of pyrethrums with great success. They graze unwanted weeds and grass, leaving the pyrethrum plants untouched. The only side-effect is very beneficial: valuable manure is provided for the fields.

World Land Utilisation

The Measurement of Potential Productivity

PROF. L. DUDLEY STAMP, C.B.E., D.SC., D.LIT., LL.D.
(*Formerly Chief Adviser on Rural Land Utilisation to the Ministry of Agriculture*)

This is a statement of tremendous significance and we suggest that regular readers of this journal should bring it to the notice of agricultural administrators and others whose task it is to guide nations in these difficult and troubled times. We would welcome correspondence on this challenging subject.



The author is Professor of Social Geography at the London School of Economics, and directed the Land Utilisation Survey of Britain. Since 1950 he has been organising the World Land Use Survey for the International Geographical Union.

NO phenomenon is more world-wide than the rapidly-increasing pressure of population. The present population is now known with a considerable degree of precision in most countries and the carrying out of a census on modern lines in China in 1953 removed the last of the great countries from a basis of estimate to a basis of enumeration. The present world total is of the order of 2,700 million persons.

Death control

Difficult as it may be to comprehend this vast total, even more significant is the present very rapid net increase. *The rate of increase in population is probably higher today than ever before in the history of the world.* This is not due to any general increase in the birth rate which, in fact, is slowly decreasing, but to the rapid spread of what has been called ' death control '. Whilst knowledge and practice of birth control make relatively slow progress, knowledge and practice of death control have become almost universal in recent decades. The conquest or at least control of such former killers as yellow fever, smallpox, cholera, plague, diphtheria, syphilis and malaria to name but a few, the increase in the number of doctors and the spread of health services have meant a tremendous lowering of maternal and infant mortality, and a great increase in the survival rate. In many countries the expectation of life in years for each infant born has been more than doubled. In consequence the net population increase is certainly over 1% per annum, and is probably about 1.3%.

At 1% per annum the population will double itself in 75 years, at 1.3% in 47 years. By 1975 the world total will certainly be over 3,000,000,000, by A.D. 2000 over 4,000,000,000. *In due course a change must take place, otherwise within a couple of thousand years, a short time in world history, there will be standing room only.*

Looked at in another way, every year there are between 35,000,000 and 40,000,000 additional mouths to be fed – it is true also that number of new pairs of hands to work – and *the world adds unto itself a population equal to the whole of that of, say, Canada in six months, or of Australia in less than four.* In 24 hours another 100,000 people – equivalent to a large town the size of Oxford or York – or more than one a second are added to the world's total.

Limitations and requirements

By way of contrast, the total surface of the earth, of land and sea, is definite, known, fixed and inextensible. Fragments, by comparison minute, may be added to the land surface by drainage and reclamation, but, broadly, the extent of the land surface is known and cannot be extended. A hundred and fifty years ago, when Robert Malthus drew attention to the inevitable relationship of population and living space, there were vast fertile lands still to be discovered, explored and settled. Now there are none. *Sustenance for the increasing human family must be obtained by extending the limits of cultivation within the known land areas, by intensifying production, by changing food habits and by cultivating the sea.*

The present situation is challenging, but by no means disastrous or even as alarming as some would have us believe. Whereas in the world as a whole there is still plenty of land, on a national basis land shortage has already become the major problem for many countries.

If we take the land surface as a whole and consider what would happen if every human being were given an equal share, it would be a little over 13 acres. But this includes an allocation of the frozen wastes of Antarctica and Greenland; of the arid Sahara; of the Himalayas and Andes. What proportion of the 13 acres can be regarded as having soil, temperature and moisture adequate for cultivation and consequent food production? Broadly, one-fifth is too cold, one-fifth too arid, one-fifth too mountainous, and one-tenth devoid of soil. About 30% is left as the ' ecumene ' or habitable area – some four acres per head of world population. How much land is actually used at the present time to support each human being? According to statistics collected by FAO, land cultivated by hand or machine and cropped is about 1.2 acres per head. Part of this is, of course, used

for non-food crops; on the other hand, the range lands or unimproved grazings of the world play their part in food production. Averaging up all the various foodstuffs and diets and the very varied levels of farming technique and technological development all over the world, *it takes the produce of rather over one acre to feed one person.*

Wide open spaces

Against this world background or yardstick of 13 acres per head, four usable and a little over one actually used, we may measure the land resources of individual countries. Among countries where land *per capita* is still so plentiful that the problems elsewhere are difficult to understand, may be noted the U.S.A. with roughly 14 acres a head – at least 12, even if Alaska is excluded. Of this about 3.5 acres are actually cultivated (improved farmland in crops and grass) and by world standards at least six acres could be classed as potentially cultivable. By any standards the U.S.A. is rich in land, and can thus afford the extravagances, eminently desirable but still extravagances, of great National Parks, huge nature reserves, numerous airfields, and super highways with cloverleaf and figure-of-eight junctions, each of which may take up a square mile of land.

Canada, that emerging giant, has no less than 150 acres of land per head. Admittedly much lies in the cold north, but official calculations allow 22 acres per head as potentially cultivable, four actually used. Another sleeping giant is Brazil with about 40 acres per head, probably 30 usable (when we have learnt properly to tame and use tropical climates and soils) and yet with only one acre actually used and food even being imported.

We think of India and Pakistan as being crowded, but the overall acreage per head is 2.1 and 3.0 respectively. Land, potentially usable, depends much on further irrigation, but is of the order of an acre per head. With regard to land actually cultivated, the position is complicated by double cropping and allowing for this India is using 0.9 acre *per capita*, Pakistan, with rich rice lands in the east and fine irrigated lands in the west, 0.74.

Overcrowded countries

By way of contrast in Britain – England, Wales and Scotland – our fundamental problem is shortage of land, with only 1.1 acre of land of all sorts for all purposes. This includes the very large area of the Highlands of Scotland, and if we look at England and Wales alone, the position is that there is only 0.8 acre per head of land of all sorts, including 0.55 acre of improved farm land in crops and grass. Hence the need for national land use planning.

But the plight of Britain is nothing when compared with the very mountainous country of Japan – with 1.1 acres per head overall (as in Britain) but only 0.15 actually cultivated because of the prevalence of mountains and steep slopes. Actually because of double and treble cropping of rice and other crops in the south, the area actually planted is about 0.22 acre per head. Whereas Britain with 0.55 acre per head puts 55% as a target for home production of food consumed, Japan expects to produce on home farms the bulk of the food consumed.

It is not remarkable that, with these utterly different backgrounds of land availability, there should be different concepts of what is meant by farming efficiency. For the U.S.A., with no land problem, efficiency is thought of in terms of output per man-hour, or in input-output ratio. That it takes the produce of nearly three and a half acres to feed one American is largely immaterial. *In Japan, it is output per unit area which matters – labour is abundant, land scarce.*

Acreage *per capita* and food output per acre for 12 selected countries

Country	*Acreage per head*			*Standard nutrition units per acre*
	Total	*Cultivable*	*Cultivated*	
Canada ..	150.0	22.0	4.0	0.4
Brazil	40.0	30.0	1.0	1.3
U.S.A... ..	12.0	6.0	3.5	0.4
Uganda ..	10.0	9.0	1.0	1.0
Burma ..	9.0	4.0	1.15	1.0
France.. ..	3.3	2.0	1.8	0.6
Pakistan ..	3.0	1.0	0.7	1.0
Denmark ..	2.5	2.0	1.8	—
India	2.1	1.0	0.9	0.75
U.K.	1.1	0.6	0.55	0.9
Japan	1.1	0.2	0.15	6.5
Holland ..	0.8	0.6	0.55	—
World	13.4	4.0	1.2	0.75

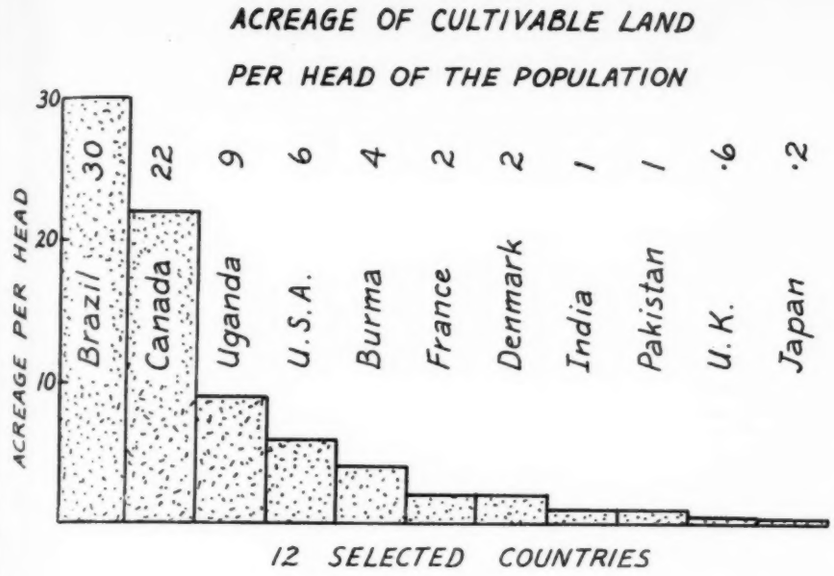
Productive efficiency

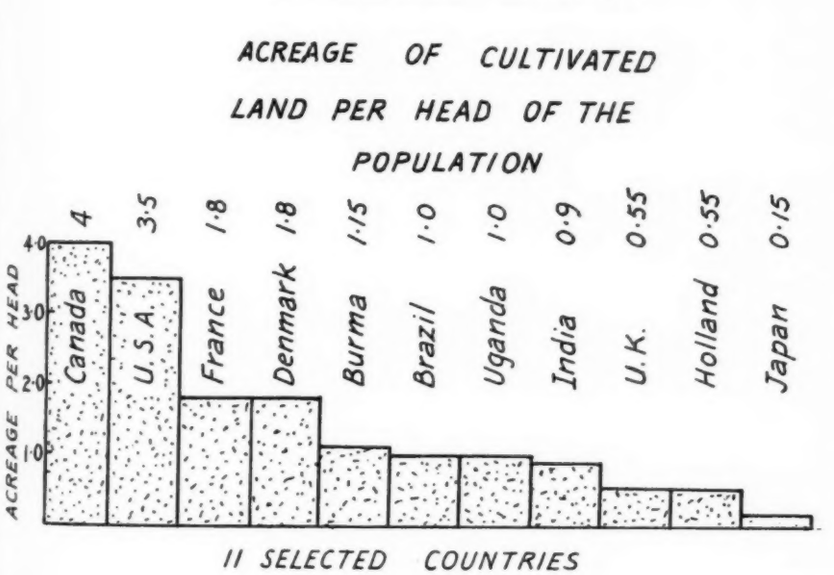
Various methods have been applied to the measurement of actual output as well as the potential output of different types of land under different types of farming. Given a standard crop such as wheat, we may compare yields of say, 60, 30, 20, 15 or 10 bushels per acre between the best European producers and the drought-harassed lands of Australia or Spain A group of countries growing the same crops may be ranged according to a ' ranking coefficient ' devised by Professor M. G. Kendall, which puts Denmark, the Netherlands and Belgium at the top, followed by Britain and New Zealand through the extensive producers, the U.S.A., Canada and the Argentine to India, Spain and Australia (for different reasons) near the bottom of the table.

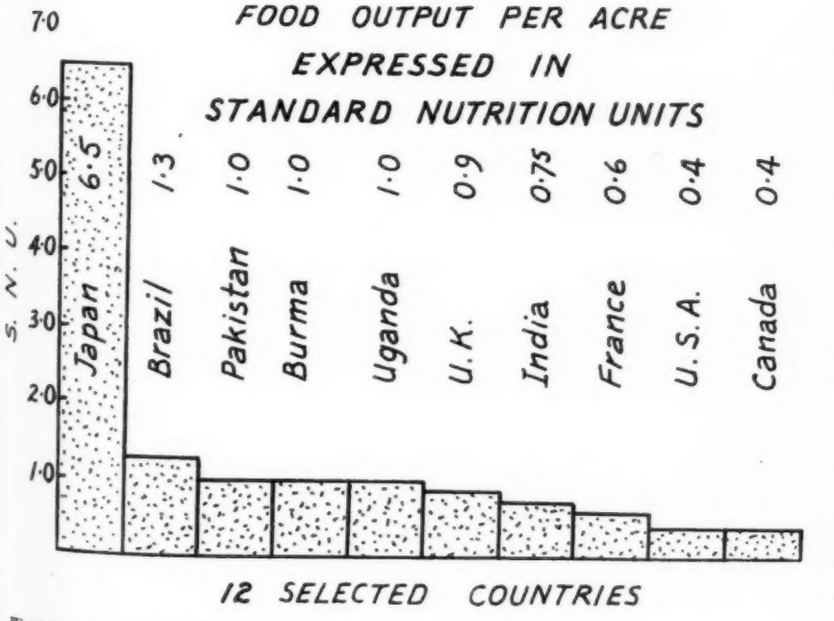
The Standard Nutrition Unit

In my presidential address to the Rio Congress of the International Geographical Union in August 1956, I suggested the use of a unit of farming output which I have ventured to call the Standard Nutrition Unit (S.N.U.), equivalent to a farm output of 1,000,000 nutrition calories a year. Because human beings eat at least once a day, the nutritionist tends to think in terms of daily intake of calories but the farmer, with an annual harvest in most parts of the world, thinks in terms of an annual production.

Under normal circumstances, there is a wastage of foodstuffs actually produced. There is preventable waste through pests which destroy food, both before and after harvesting, and preventable waste in food thrown away after cooking – a high proportion in some countries – but there is the







minimum waste involved in preparation of food for eating after harvesting. Elaborate tables are published in FAO in *Food Composition Tables for International Use* of the loss in preparation and cooking: notably important is the rate of extraction of flour from grain, but a working average is 10% so that the 1,000,000 calories harvested become 900,000 calories of available human food.

Every diet must include (a) carbohydrates which yield energy first for the maintenance of life and secondly for a varying degree of activity, (b) proteins for the growth and repair of the tissues and (c) a wide range of substances in small quantity, both organic and inorganic, required to maintain the body in full health and vigour. Provided the diet is sufficiently varied, a quantity adequate for the production of energy is likely to include an adequate supply of protein, especially if including milk and meat, whilst any deficiencies in the third group can be detected and remedied, or naturally countered by the intake of the so-called protective foods.

Feeding a hungry population in a crowded country becomes primarily the production by the farmer of an adequate supply of calories. *If land is short, there is an almost automatic reliance on high-calorie and high-yielding crops such as rice and wheat* (with cooked rice and bread the basis of diet); *if land is abundant there can be increased use of meat and milk which are extravagant of land.*

The Standard Nutrition Unit of 1,000,000 calories a year farm production, 900,000 calories of consumable food is equivalent to 2,460 calories a day – the average requirement for the maintenance of health and vigour for the people of north-western European or of American height and weight and age composition, hence the justification of the term ' Standard Nutrition Unit '.

The advantage of this unit is that it can be calculated independently of the crop grown or the food consumed. The *Manual of Nutrition* published by H.M.S.O. enables the calorific value of a given weight of any foodstuff to be calculated.

We come accordingly to the *area of land* required to produce one S.N.U. Making due allowance for seed and with a high extraction rate, 11 bushels of wheat harvested provide one unit,

so that an acre yielding 44 bushels would give four units, or support four people. In Britain at an average yield of seven tons of potatoes per acre, the yield (allowing for bad peeling and a loss of 25%) is rather more than four units. But with milk, even with a 1,000-gallon cow, the yield from an acre of crops and grass is only just over one unit. With an average dairy herd it is considerably less. Though calculations are more difficult, the production of meat is even more extravagant of land – with beef under British conditions it requires about two and a half acres of improved farm land (crops and grass) to produce one unit.

Summarising, we are now in a position to compare the countries of the world not only in their acreage of actual or potential food-producing land, but also in their ability, given their varied types of diet and types of farming, to support human beings. If we like to call this ' efficiency ' as it is in one sense, the highest efficiency is reached with the intensive hand cultivation of rice and vegetables – with protein derived from beans and fish, and with very little meat or milk – practised perforce in Japan with an output of six or seven Standard Nutrition Units per cultivated acre. This is roughly seven or eight times as ' efficient ' as England, roughly 20 times as ' efficient ' as the U.S.A.

Where two countries enjoy approximately the same conditions of climate and soil and grow the same crops we can compare the actual efficiency of their farmers and farming techniques. The rice farmers of India and Pakistan in this regard come out very badly when compared with Japan or China – which is, of course, suggested by crude yields.

Within a given region or small country, calorie yields give a measure of the *relative* production of different types of land. We talk a great deal about the conservation of ' good agricultural land ' without having any measure, other than an empirical or subjective judgment based on general knowledge. Yet in Britain it is probably true that some of our finest lands have 20 times the productive capacity of the poorest of the ' marginal ' lands. It is for this reason that I have previously suggested a ' Potential Production Unit ' to represent the productive capacity of good average farmland. This is a comparative not an actual unit of measurement which would increase with technical advance.

Some of the foregoing considerations relating to a number of countries of varied character are strikingly illustrated in the table and charts which accompany this article.

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Mediterranean Area Development

Large-scale reafforestation for countries bordering the Mediterranean, and land and water conservation schemes, were considered at the FAO Conference last November. The programme will at first concentrate on the central and eastern Mediterranean countries, from Tunisia and Sicily in the West to Iraq in the East.

Deforestation has contributed considerably to the economic decline of this formerly fertile region. The problem of land and water conservation and improvement is held up by a desperate shortage of capital, which prevents proper consideration of long-term policy. The area is in no way as poor in resources as it might appear, but large areas of unused land will continue to lie waste unless steps are taken to restore their fertility, improve the water supply and render them more accessible.

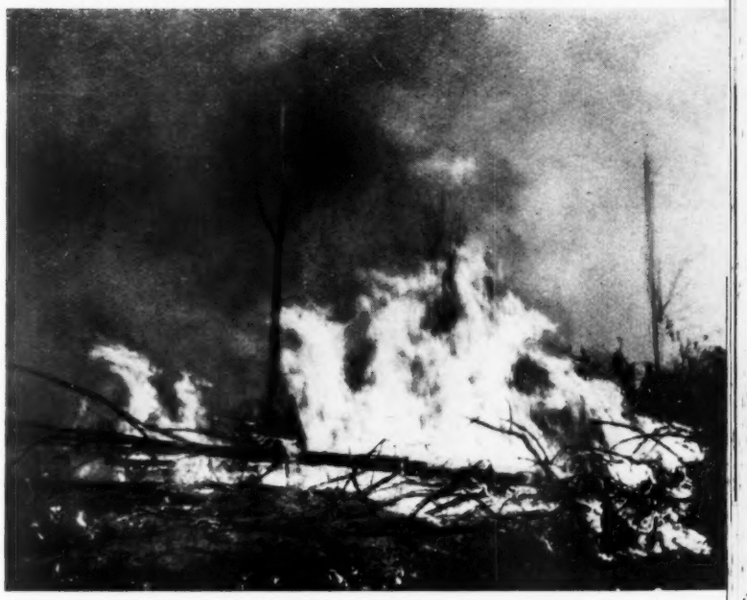
Restoration of the forest cover in a broad setting of technical development has been selected as the starting point. An extensive programme of tree planting and forest management would help to provide employment for the surplus rural population. A forest cover would improve soil fertility and retain the rainfall, and it also would protect the soil against erosion. Later on it would provide timber and reduce the need for imports.

Pesticide Residues Under Consideration

The Pesticides Group of the Society of Chemical Industry with Dr. F. P. Coyne in the chair, following the symposium reported in WORLD CROPS, 1958, **10**, 58

Jungle Clearing in Malaya

In addition to extensive replanting programmes which are in progress throughout Malaya, a small but steadily-increasing area of new planting, mostly on jungle land, is being undertaken annually.



A 'burn' in progress

BETWEEN 1934 and 1941, the Rubber Restriction Scheme either prohibited new planting or permitted only a very limited amount apart from planting done for experimental purposes. During these years, soil conservation problems were receiving increasing attention and wherever new planting was undertaken there was a general departure from the older methods of clean clearing of surface timber in favour of the minimum amount of clearing and burning after felling.

Towards the end of this period the accepted practice was either to fell jungle and put a light 'burn' over the area or, where the jungle was not too heavy, to fell and prepare the land for planting without any burn. Both methods aimed at reducing soil exposure. Clearing without burning achieved this object more completely but, briefly, the theoretical advantages of leaving the jungle unburned and stacked between planting rows – thereby conserving all humic material and avoiding any sterilisation of soil by burning – met with certain practical disadvantages. Amongst these were the difficulty of movement for labour and supervision, the difficulty of controlling root disease and undesirable growths, including lalang, increased pest damage and danger of accidental fire.

Clearing without a burn was usually only slightly more expensive where the jungle was light. However, with the increasing high cost of present-day labour, the margin in favour of a light 'burn' is likely to be considerable and probably sufficient to abandon ideas of clearing without a burn.

Mechanical methods

To combat increasing labour rates, both heavy and light tractors are being used with a variety of equipment for all manner of estate work. If it is required to use tractors and mechanical equipment for estate maintenance work, then it will be necessary to revert to cleaner clearing methods initially to enable the tractors to move freely within the area. The degree of clearing of surface timber and stumps for this purpose would depend on just what type of equipment it is intended to use in the area in future. Clearing of this nature could be undertaken with heavy tractors.

Excessive disturbance of the soil by uprooting jungle stumps and dozing with heavy tractors would however undoubtedly mean sacrificing the best of soil conditions to obtain a surface free of heavy timber. In the steeper areas and the wetter land, machinery could not be used. Clean clearing and deep rooting of old rubber land for replanting may be justified in that it helps to eradicate root disease but on jungle soil, where root disease is not normally so prevalent, the economic advantage of this practice is questionable. The cost of clean clearing by tractors would be more expensive than the normal amount of manual clearing necessary along the planting rows after a light burn, and on grounds of expenditure alone this higher initial cost would need to be evaluated in connection with any estimated reduction in subsequent costs of maintenance.

Manual clearing

A few notes on the present manual method of preparing jungle land for planting may be useful.

The boundary of the clearing should be demarcated with a 'rentis'* about 6 ft. wide and all available timber.

Fire Belts – As the area is to be burned, it will be necessary to leave a strip of standing jungle along any planted boundary or forest reserve to avoid damage by scorching or by accidental fire to adjoining property. A strip of jungle about two chains† wide should suffice. Care should be taken to keep this lane clear of timber; no trees should be felled across the clearing, whereby dead wood in the fire belt could easily catch fire.

Felling – First all belukar‡ should be slashed to the ground. The trees should then be felled at a convenient working height. Subsequent clearing operations are much easier if the trees are felled as far as possible in the direction of the future planting rows, or on the contour if the land is hilly.

Burning – The severity of the burn will depend upon how long the felled jungle is left to dry out. By burning off about two months after completing felling, a sufficiently light burn of the brushwood and smaller timber will be obtained. Large areas are better burned off in blocks of 100 to 150 acres at a time. Between these blocks there should, of course, be a very safe fire

*Rentis: a lane through jungle.
†Chain = 66 ft.
‡Belukar: secondary jungle.

General view of burnt area before timber had been stacked along the contours

Steep part of the clearing with timber stacked on contours, showing a corner of the unburnt jungle in the background

belt of standing jungle.

A safe and satisfactory method of burning is to light fires at frequent intervals around the perimeter of the clearing and to allow the fire to develop and spread inward of its own accord. If any one boundary of the clearing appears to present a particular fire control problem, it would be better to light that side first and give it a start on the remainder of the clearing. Adequate labour should be provided and equipped suitably for fire-fighting and watching along the boundaries until the danger of fire spreading is passed.

An alternative method of burning, frequently advocated, is to clear rough tracks through the felled jungle at intervals of 5 to 10 chains and to put a gang of labourers through the clearing in line abreast formation lighting fires as they proceed, preferably against the wind, from one boundary to another. This will give a quicker burn but it is difficult to control over large areas.

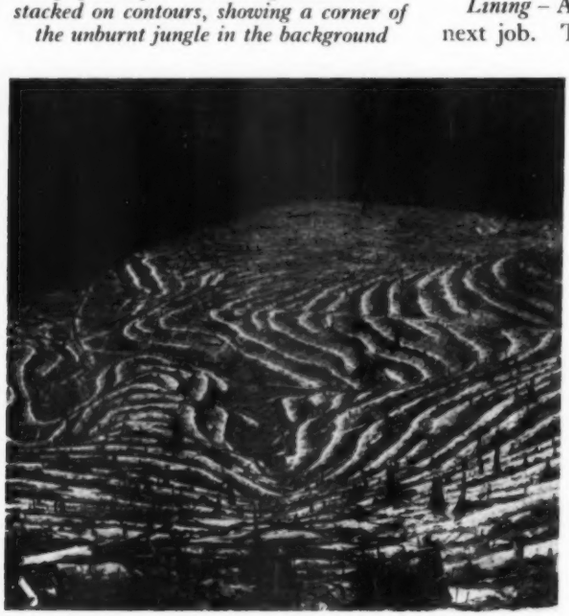
Whichever method is adopted all labour taking part in the burn should be well briefed in their duties, and the various boundaries or sections of the clearing should be put in charge of responsible people. The essentials for a successful burn are (1) that there have been at least three days without any rain, (2) that the overnight dew has been dried out by several hours of sunshine and (3) that there is at least a slight breeze. It is advisable to notify local authorities and neighbouring estates of the intention to burn.

Lining – After burning, lining is the next job. This needs no description and can follow any required pattern. Where much timber remains after the burn, however, it would be advisable to do the lining in two stages: first, to mark a skeleton lining of the planting rows with pegs a chain or more apart and later, when the timber has been cleared from these rows, to peg the planting points accurately.

Clearing – All unburned loose timber should be cleared from a 5 to 6 ft. width along the planting rows or contours. This work will be made much easier if the felling has been well done and the trees are lying roughly in line with the planting rows. It is advisable to give both felling and clearing work to the same contractor (and the same labourers, if possible) to insure reasonable and cheaper work. The logs are sawn into convenient lengths and slewed between the planting rows.

The extent of stumping along the planting rows rather depends on funds available. It would be sufficient to remove all stumps up to 6 in. in diameter from the planting row. Larger ones could be removed in the vicinity of planting points, but where stumps, much beyond 12 in. in diameter, interfere with planting points, their removal would not normally be worth the cost. Such instances are remarkably infrequent and the initial planting density would no doubt allow a certain reduction in stand by thinning which could absorb such vacancies. If the clearing is to be terraced, stumping can be done in conjunction with terracing.

Abstracted from the Planters' Bulletin of the Rubber Research Institute of Malaya, November 1957.



Six months later – the cleared area ready for contour planting

Development in Mexico

After 10 years of tremendous activity an important stage was reached in the Papaloapan scheme when the gates of the President Alemán dam were recently closed and the storage of 8,000 million cu. m. of water was begun. The Papaloapan basin is a region with high and rugged mountains in the west and with a vast low-lying plain in the east. Some eight major rivers water the region and for centuries the coastal plain has been ravaged by floods. The operations included the building of great embankments, the straightening of rivers and the construction of dams, irrigation canals and roads.

Land Classification for Irrigation Development in Iraq

H. GILLMAN, M.SC., A.I.C.T.A.
(Hunting Technical Services Ltd.)

It is a truism that the utilisation of new land for agricultural purposes should normally be preceded by some assessment of its suitability. This is a reasonable precaution to take even when planning the development of a single farm. It is even more important if the contemplated use of the land involves large-scale development with costly capital works, as, for example, the development of reclamation projects or vast irrigation schemes.

THE need for first obtaining a sound appraisal of the overall suitability of the land as a first stage in any irrigation development is becoming more generally accepted, and such an appreciation has in fact been a particularly notable feature of the spectacular expansion in irrigation projects which is taking place in Iraq as part of its far-reaching development plans.

With a vast alluvial plain traversed by the twin rivers Tigris and Euphrates, there have always been great potentialities for extending the present irrigated lands of Iraq to new areas or to areas which in ancient times had formerly supported a flourishing agriculture. What was needed to achieve this expansion was to control the seasonal flow of these rivers, to lead the waters into those new project areas whose prior assessment had confirmed their suitability for development, and to ensure that an efficient drainage system was provided, so that the ever-present problems of excessive salinity or a variable water table could be resolved.

With the considerable revenue derived from the Kirkuk and Mosul oil fields, a wise Government has been able to embark on a far-reaching development plan – a programme which has involved, through the agency of the Iraq Development Board, the construction of dams and barrages to control the flow of the rivers and the development of a series of irrigation projects.

Aerial view of an already existing fertile agricultural area in Iraq. The main crops are dates, wheat and barley; the irrigation drains and ditches can be seen

A sound precaution

The design and construction of the irrigation and drainage works for the various projects has been entrusted to several groups of engineering consultants, drawn from several overseas countries, including Britain, the U.S.A., the Netherlands and France.

A typical farmer with a wooden mould in Arabic script used to indicate his possessions

But the Iraq Development Board, realising that the economics of the engineering, as well as the agricultural and social development aspects of these irrigation projects, must rest on a sound preliminary assessment of the soil, have prescribed that no detailed engineering planning should be started until a soil and land classification survey of each project area has been completed.

With tens of thousands of square kilometres of project areas to be surveyed within a period of a few years, there was no possibility of the technical resources of the Iraq Ministry of Agriculture being able to deal with a task of such magnitude. The training of specialist staff to deal with this increased programme of investigation is proceeding, but in the meantime it was necessary to call in foreign specialists to undertake these studies.

Five organisations from the U.S.A., Britain, France and the Netherlands have sent teams of soil, drainage and agricultural specialists to carry out the investigations involved in classifying the land and advising on drainage problems and agricultural practice.

The projects

Hunting Technical Services Ltd., a British organisation which undertakes such investigations, sent a team of specialists to investigate, on behalf of Binnie Deacon & Gourley, four project areas known collectively as the Z.A.D. (Zab-Adhaim-Diyala) irrigation projects. The four areas in the Z.A.D. irrigation projects were the Nahrwan, the Adhaim, the Makhmour and the Ishaqi areas; the Nahrwan (3,800 sq. km.) being on the left bank of the Tigris, south of Baghdad, and the Adhaim (1,950 sq. km.) on the left bank of the Tigris, north of Baghdad. Both these areas had been irrigated in ancient times, but are now arid grazing lands. The Ishaqi area (1,530 sq. km.) lies to the north-west of Baghdad on the right bank of the Tigris and much of this is already irrigated by pump from the Tigris. The Makhmour (2,455 sq. km.) lies to the north-west of Kirkuk, its climate being a steppe climate as distinct from the desert climate of the other three areas, and is fairly fully utilised under rain-fed winter crops. The accompanying sketch map indicates the localities of the four project areas.

On completing the Z.A.D. survey, the Hunting Technical Services team then proceeded, on behalf of Sir Murdoch MacDonald & Partners, with similar soil, land and agricultural studies of the Diyala–Middle Tigris Irrigation Projects. These projects cover a further 18,760 sq. km. of land, comprising the Diyala River Basin below the Derbendi-Khan Dam and two strips of country on the right and left bank of the Tigris between Baghdad and Kut. These projects are also indicated in the sketch map.

The problem

It is the purpose of this article to outline the objects and methods of these soil and land classification studies carried out in Iraq over the past three and a half years and due for completion by early 1959.

The basic information required by the engineers for their project planning and canal design was the assessment of the irrigation development potentialities of the different lands occurring in each project area, the extent and distribution of these soils to be presented on maps of appropriate scale.

The location of the areas covered by the soil survey and land classification carried out for the Iraq Development Board

For the preliminary planning purposes involved, a semi-detailed reconnaissance type of land classification was required, and for this 1/50,000 mapping was the most suitable scale. On the basis of this survey, the lands were to be grouped into three different use-potential or capability categories so that future planning and design could confine itself to the areas possessing the better categories of land and avoid those areas associated with certain limitations to agricultural use, such as excessive salinity or poor drainage or shallow soils. Where limitations of a moderate degree of intensity occurred, recommendations would be needed on how to correct these adverse characteristics, such as through leaching of salts by proper drainage. Furthermore, since the future engineering planning would also have to take into account possible changes in current farm practices, a study of the existing agriculture was required so that suitable modifications and improvements could be recommended to ensure the best use of the land and of the water and so that farm holdings of a suitable layout and optimum size could be designed.

The team

In order to cover all these requirements, the team sent out to Iraq consisted of several types of specialists. The soil survey itself was carried out by soil surveyors numbering at least six, and for a considerable time as many as eight. Their work was co-ordinated and supervised by a senior soil specialist who was also responsible for drawing up the soil classification and for grouping these soils into the prescribed system of land classification. The team also included a soil chemist, attached to the Government Soils Laboratory which carried out the analyses of the many thousands of samples collected, and a soil physicist to work specifically on soil permeability studies in the field. With vegetation often playing an important diagnostic role in such land classification studies, it was essential to have a plant ecologist for at least part of the time in order to

identify the different vegetation communities and relate them where possible to soil or land conditions. And finally there were the agricultural studies requiring the presence of an agriculturist as well as an agricultural economist. In all, the team stationed in Iraq was seldom less than ten specialists and on occasions it was expanded to as many as thirteen or fourteen.

Digging a soil pit. The desert nature of the land reflects the low annual rainfall in this area, which is only 6 in.

Method of operation

The soil survey and land classification itself was based on the specification of the U.S. Bureau of Reclamation for semi-detailed land classification surveys but modified slightly to meet the requirements of these particular projects, *i.e.* soil examinations had to be made to a density of at least one site per square kilometre with the actual siting being left to the discretion of the soil surveyor. The fullest use was made of aerial photography taken, as far as possible, in the period when the different plant communities could be clearly distinguished. This, of course, was not always possible, but even without the vegetation communities being clearly discernible the photographic tones, textures and patterns reflected other differences such as crop vigour or topographical and lithological changes which could be associated with soil variations.

The photography was at a contact scale of 1/15,000 or 1/20,000 and the survey teams were provided with sets of contact prints and two sets of photographic mosaics, one at contact scale and the other at 1/50,000 scale. These mosaics provided a comprehensive picture of the area to be surveyed and enabled the survey teams to plan the sampling programme for each area. The selection of inspection and sampling sites on the basis of the photographic pattern ensured that each site was as representative as possible of the different units of land being surveyed, and such a selection was likely to be of greater value than if the sites had been regularly spaced on a grid layout.

At each inspection site, the soil profile was examined, described and sampled to a depth of 1½ metres (5 ft.). The majority of the examinations were based on auger samplings, the 12.5 cm. Jarrett auger being used for this purpose. Soil pits were also used, particularly for the purpose of describing representative examples of the different soil groups and their several facies, and for the collection of soil samples for comprehensive analyses. One soil pit or soil boring in every 25 was to a depth of 5 metres (16 ft.) so that some knowledge could be gained of the deeper horizons and of the water table conditions at lower levels.

Taking soil samples with a Jarrett auger. The surface pattern of the ground is indicative of the saline soils which can be found. Such salinity may prove a limiting factor to agricultural development.

Soil classification

It was the usual practice to carry out an initial rapid reconnaissance of each project area in order to recognise the major soil groups and draw up a preliminary soil classification based on field texture, structure, consistency, colour, depth, salts and gypsum. This took about two or three weeks, after which the main semi-detailed survey, covering the whole area in a systematic manner, would be proceeded with.

Descriptions of the soil, the topography, the drainage, notes on vegetation and crops were recorded in the field, together with the preliminary classification of the soil. This preliminary classification was later modified in many instances in the light of the laboratory results received, particularly those of the salt content.

The prints were used in the field to

record on them the precise position of each examination site. Where possible, and with the help of a stereoscope, these prints were also used to relate the topographic features with the photographic pattern, and were used for any such soil mapping as could be carried out on the spot.

It may be mentioned that with an examination density of one per square kilometre it was only possible to map to a scale of 1/50,000 by making every possible use of aerial photography. Photography was particularly useful in delineating the bad-structured soils of the depression areas and the soils of the sand hills; at times, as in the Diyala Survey, where the land was largely under crops, the soil changes were obscured and interpretation and the drawing of soil boundaries became more difficult. Even under such difficult conditions, however, the plotting of the boundaries could be accepted as more accurate than if they had been interpolated without the help of aerial photography.

This information recorded in the field on the contact prints would then be transferred to 1/20,000 mosaics, marking up each sampling site with its serial number and its classification symbol. After this the soil boundaries could be plotted, either by photo-interpretation or by interpolation, and a preliminary soil map produced. The next stage would be to transfer the soil boundaries to the series of 1/50,000 semi-controlled mosaics in preparation for the final stage of plotting the boundaries on the 1/50,000 base maps.

Sampling a soil profile in a soil pit. Note the poor structure of the subsoil

Land classification

The soil maps, thus produced, together with the topographic and drainage status at each site, formed the basis on which the land classification maps could be drawn up. As the main object of the survey was to assess the land's suitability for irrigated agriculture, the system of classification employed was the one adopted by the U.S. Bureau of Reclamation for irrigated land use, but modified to meet the needs of the irrigation projects in Iraq.

The Bureau's land capability classes are numbered from 1–6, the capability rating being graded from Class 1 for choice arable land down to Class 6 for non-arable land of no potential irrigation use. For the Iraq reconnaissance survey, however, the specifications required that all land not falling within the first three classes should be grouped as Class 6.

As the physical state of the soils, their permeability status and salinity at depth ruled out the possibility of classifying any of the soils as Class 1, the classification was in fact reduced to three categories, namely Class 2 and 3 arable lands, and Class 6 representing the non-arable land.

Of the arable lands, the Class 2 land included all the non-saline soils or soils of low salinity with moderately good structure, coarse to medium textured, and not limited by topography or drainage. Class 2 land is therefore land which is suitable for immediate use without requiring any special ameliorative measures.

The Class 3 lands are those which are of a lower category than Class 2 because they possess moderate limitations to agricultural use. As several limitations were found, either singly or in combinations, the land classified as Class 3 was sub-divided into several sub classes according to the limitations found, such as land possessing salinity, structural, drainage or topographic limitations. In this way, the nature of the problem occurring in each area of Class 3 land was distinguished and the necessary ameliorative measures could be prescribed.

In accordance with the specification adopted for these particular surveys, Class 6 land was defined as including all such land which did not meet the minimum requirements for Class 3 land. That is, land which possesses the various soil and topographic limitations to a more pronounced degree and was consequently unsuitable for economic development.

The extent and distribution of each of the above three land classes was mapped, again at 1/50,000 scale, and the maps were produced in three colours so that each land class could be clearly distinguished. In the case of Class 3 and 6 lands, the different limitations were indicated by symbols.

The final report

The land classification maps, accompanied by a comprehensive report, were thus the end products of the operation. They represented the final interpretation of all the basic information on soils, topographic and drainage conditions collected during the course of the survey, and showed the engineers and those concerned with the development of the project area, where the potentially useful land was located, how much of each category of land was available, and the nature of the land utilisation problems which would have to be dealt with. The recommendations on this latter aspect and the reasons for making them, were fully considered in the report, which also gave a complete description of all the soils, including analytical data, of the physiography, the climate, the vegetation and of the land use practices in each area. The main purpose of the present account simply is to indicate the vital importance of classifying land wherever land development is contemplated, and to describe how such land classification was carried out in Iraq.

The Problem of Flood Mitigation

with special reference to New South Wales

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AND
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Floods are a natural phenomenon, the effects of which can be mitigated if effective counter measures are taken. Such measures are better land use, gully-plugging, the building of check dams, ponds and reservoirs, the protection of river banks and the straightening of the rivers at strategic points. This article has a lesson and a moral for all countries having similar problems.

IN most parts of the world, the flooding of river valleys occurs periodically. Even great cities – London, Paris, Cologne and Rome, for instance – have suffered. In some areas where melting snows raise the rivers in spring, the occurrence of floods can be predicted with reasonable accuracy, but in Australia, due to an erratic rainfall, they may occur at any time of the year and along any of the rivers.

It has been well stated by an eminent consulting Engineer of New York, Mr. Gerard H. Matthes:

'The problem basically is not so much an engineering as a human problem that grows out of the ever-expanding trend for population to crowd into the natural flood plains – Nature's appointed pathway for flood waters'.

Man's contribution

Floods have occurred from time immemorial as part of nature's cycle, and they will continue. Man, by his action in settled regions, has added to their destructive power: firstly in a direct manner by destroying the natural cover of trees and grasses that are essential to the stability of a catchment area, and, secondly, by building his homes and industries on the flood plain.

Much damage has been caused over large portions of the various catchment areas throughout New South Wales by forest denudation, over-stocking and unwise land usage generally. Where rainfall once was absorbed into a hillside, sheltered by a protective cover of trees and vegetation and carpeted with forest litter, it now strikes directly at the unprotected soil which, unable to absorb it quickly, allows it to pass on unchecked to the valley below. Soon the hillside is scarred by gullies cut in the softer earth and these in turn serve to channel the water with each succeeding rainstorm until volume and velocity combine to carry large portions of silt and gravel into the main stream. The river bed is raised, 'silted up' is the popular term, and large quantities of good topsoil are lost.

Closely related as a cause of river siltation is the practice of cutting out timber along the banks of a stream. All river banks need the protection of a root system given by trees and other vegetation. Without that it is only a matter of time before the extra velocity of 'freshets' or high river will cut into the banks causing them to topple or slide into the stream. In those cases the permanent loss of much good land is added to the damage to river beds.

In so far as the actions of man contribute to the severity of flooding, it is necessary to check the ill-conceived practices that are responsible for it. Other remedies, however, are not so easily determined and it is only

Photo : International Harvester Export Co

One of the ways to take care of deep gullies is to build check dams across them. Further erosion is halted and the gully may eventually fill up with silt. The dam shown here is 150 ft. long and 25 ft. high

Farm dams with well-vegetated banks are an integral part of erosion control programmes in New South Wales

common sense that the price paid for occupying a flood plain should bear a reasonable relation to the advantage gained by such occupancy.

Principles of protection

There is no quick and easy way of giving worth-while protection against floods. Any scheme to be of lasting benefit must embody within its framework a succession of works extending from the extremities of a catchment area to the river mouth. A flood-control dam would almost certainly be a necessity where protection is to be given over a large area; but it alone will not effect a complete remedy.

It is not the volume of water passing down a stream that causes flooding, but the volume in relation to time. If land management over a catchment area is efficient to the extent that natural coverage is maintained, and tilth and soil structure improved, then the rate of absorption of rain water into the soil will be increased and the water thus held in a natural reservoir will discharge gradually into the stream. By such means the intensity of flood peaks is reduced without diminishing the total volume of flow.

Correct land management of a catchment area also gives protection to the river bed against siltation and thereby ensures that the channel's capacity to accommodate normal flows is not restricted. Similarly flood-control reservoirs are protected from silting up.

Further protection against siltation is afforded by river and foreshore improvement work which itself is a necessary part of any comprehensive flood mitigation scheme. In general this involves stabilising a river bank in parts where erosion is occurring, or is likely to occur, and clearing the channel of obstructions, such as logs or weed growth. Protection to the banks is sometimes given by the construction of a groyne at a critical spot, but a permanent remedy is generally obtained only by the re-establishment of trees and natural grasses which in time will consolidate the bank by a combination of root growth and surface coverage.

Where siltation has already seriously affected the capacity of a stream bed to accommodate normal flows, it may become necessary, as part of a flood mitigation scheme, to dredge the river. It might also be necessary at certain points to straighten the course of a river, eliminating, or by-passing, bends that act as a check to the rate of flow.

In the United States of America catchment area protection works, leading to the prevention and correction of erosion, are applied as standard maintenance measures in the case of all storages, new and old. The soil conservation works carried out in association with the Tennessee Valley Scheme show an awareness by that Authority that regional plans involving huge hydro-electric generation works, irrigation schemes, flood control, navigation and other river works hinge on an adequate soil conservation programme throughout the Valley uplands.

Where there is uncontrolled erosion there is rapid run-off, carrying soil, resulting in the flooding of rivers, river bank erosion and siltation of irrigation and flood mitigation storages. In the lower estuaries, channels are filled with silt, thus lessening flood flow outlets, increasing flooding of the alluvium, restricting or eliminating river navigation and rendering harbours unworkable.

Flood devastation

Where there is uncontrolled run-off from eroding catchments, a high percentage of the rainfall forms the flood peak in a short time. In the February 1955 flood, heights of 50 ft. were recorded in the Goulburn River near its confluence with the Hunter at Denman, and 40 ft. in the Hunter at Maitland.

Enormous amounts of sand, silt, gravel and other erosional debris were carried downstream by these northern inland rivers, and also the coastal Hunter, during these floods, and deposited in towns like Singleton and Maitland and over thousands of acres of river flats to depths of up to 10 ft. In a previous flood on the Hunter, 8,000,000 cu. yd. were deposited in the dredged channels alone of Newcastle Harbour.

It is a reasonable deduction that unless priority is given to major soil conservation works on the catchment areas then flood mitigation and irrigation storages in these northern rivers will on completion rapidly be filled with silt instead of water, their purpose will be nullified, and the capital investment of the dams and ancillary works will be lost.

Flood mitigation measures

The five main approaches to flood mitigation are:

1. Forestation or reforestation of the steep lands around the perimeter of catchment areas.

2. Soil conservation work, mechanical and vegetative throughout the valley uplands.

3. Flood mitigation dams in the

tributaries and the main river.

4. River improvement work, including river bank erosion control.

5. The removal of towns and villages from the flood plains, where necessary.

The first two of these measures are essentially of a land-protection, soil conservation nature. Forest growth on the steepest lands of catchments is a primary requisite to the soil conservation approach to catchment area protection. Not only does dense forest lessen the run-off and loss of soil from the lands upon which the forest grows, but also it lessens the load on both the lower hilly lands and the high tributary creeks by ensuring that less high velocity water from these top lands flows across the lower lands and into the creeks.

A gully check dam and diversion bank to control run-off from steep slopes in the Tenterfield district of New South Wales

Upstream or downstream ?

There has been some difference of technical opinion as to the relative importance of upstream and downstream flood mitigation works. Study of the behaviour of New South Wales rivers during repeated floodings indicate that in that State both upstream and downstream measures are essential, that they are interdependent, but that *the starting point should be the top of the catchment.*

Forestation and soil conservation work throughout the undulating and hilly lands of catchments are essentially upstream flood mitigation measures undertaken by those primarily trained in soil and biological sciences. Flood mitigation dams and river improvement work have been, up to the present, primarily downstream engineering works. Much more of the latter than the former have been carried out, particularly by way of levee banks and river diversions.

Protagonists of the upstream approach have pointed to the repeated failures of these downstream works and to the fact that storages, whether *the dams have been built for irrigation, flood mitigation or both, have filled or are filling with silt at an alarming rate,* and this measure will also prove ineffective in the absence of revised ideas as to the scale of upstream flood mitigation measures necessary. They point also to the huge sums of money spent on harbour dredging and wonder whether much of this work could be avoided if there were more soil conservation works to ensure retention of the soil *in situ* on the lands of the catchment.

In most of the river valleys of New South Wales extensive reforestation is essential and soil conservation measures throughout the whole of the uplands are urgently required, particularly in the catchments of all the western flowing rivers, and also the Hunter and Snowy, flowing eastward. Downstream engineering works, and especially flood mitigation dams, are of great value, and in fact essential, as the third major flood mitigation measure.

Following the necessary forestation or reforestation of steep mountainous lands around the rim of any catchment area, the mechanical and vegetative soil conservation works on the undulating and hilly arable and grazing lands of the valleys are the next logical step. These may be considered under four headings :

Farmers woodlots

As distinct from large-scale forestry work, the establishment of small timber plantations on the individual farms, or the improvement of existing stands of timber by sound sylvicultural practice, is a valuable soil conservation measure, provided stock and vermin are excluded and these timbered areas protected from fire. There is good reason why timber, to the extent of up to 5% or even 10% of upland holdings, should be considered as a remunerative farm crop, over and

Thick plant cover on an artificial waterway enables water discharged from graded banks to be carried away without damage

The recent floods in Ceylon destroyed many thousands of acres of paddy fields. This picture shows a part of a concrete bridge that has been carried away

above its value rainfall as absorbent.

Establishment of dense pastures

By reserve stocking, proper placement of water supplies, sound subdivision, topdressing with suitable fertilisers (by air if necessary), and sowing improved species of grasses and clovers as applicable to the individual holding, pastures of the uplands can be so thickened up as to form, in themselves, an absorptive blanket over vast areas. This is not only resistant to erosion but so spongelike that, even in very heavy downpours, little surface run-off occurs.

Mechanical soil conservation works

These measures are introduced on undulating and hilly, eroding farming and grazing lands in order to (*a*) increase absorption of water by pondage and (*b*) assist in increasing vegetative growth and improving soil structure, which in turn results in greatly increased infiltration and the building up of nature's reservoir – the soil.

These mechanical measures comprise, in the main, sub-soiling, pasture furrows, absorption banks, graded banks, grassed waterways, silt dams, gully structures, water-spreading devices and absorption areas. They are based on the principle of continuously spreading water on the contour across the farms, delaying the time of concentration and thus absorbing a much higher proportion than is the case when the water flows naturally from top to bottom of the slope by the steepest route, gullying as it goes.

Improved cultural practices

The proper rotation of crops, including long periods of clover-grass ley, stubble retention and stubble mulching, topdressing of stubble and contour cultivation are an essential adjunct to the mechanical measures.

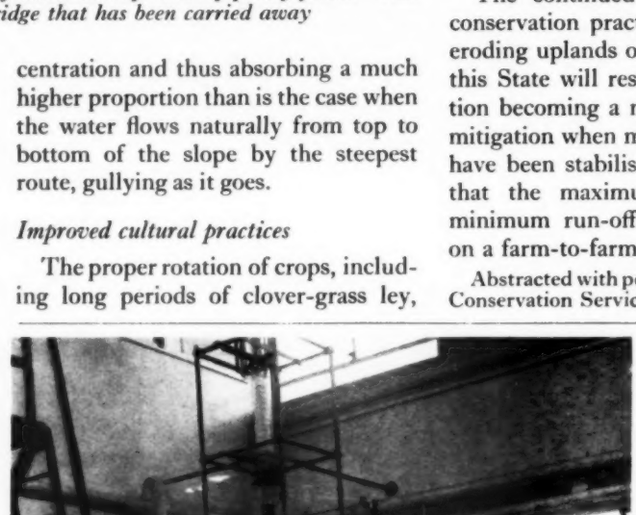
Conclusion

There are 73,000 rural landholders in New South Wales of whom slightly more than half have an active erosion problem. This means, broadly, that two or three times as much rainfall is running off these eroding farms as would be the case under a sound system of soil conservation farming; this additional run-off carries valuable soil and contributes to flooding in the various rivers of this State.

A good start has been made in the installation of soil conservation work on a State-wide basis; however, decades of such work are necessary before soil conservationists will feel confident that present scientific techniques have been applied to most of the eroding farmlands of New South Wales.

The continued application of soil conservation practices throughout the eroding uplands of the river valleys of this State will result in soil conservation becoming a major factor in flood mitigation when most of these uplands have been stabilised to such a degree that the maximum absorption and minimum run-off has been achieved on a farm-to-farm basis.

Abstracted with permission from the Soil Conservation Service, N.S.W., Australia



The Tropical Products Institute is now established in new premises at 56/62 Grays Inn Road, London, where enquiries are received from all over the world. This is a corner of the pilot plant laboratory, showing a still and fractionating column for the examination of essential oils and perfumes
The T.P.I. Laboratory dealt with 745 inquiries and completed 95 investigations during the past year

The Application of Hydrostatic Transmission to Tractors

H. J. HAMBLIN, B.A., M.I.B.A.F.
(*National Institute of Agricultural Engineering*)

This is an account of a tractor with unique simplicity of control resulting from the application of hydraulics in its design.

THE transmission of power by *hydraulic* means is achieved either by the straightforward transmission of pressure within a fluid from one point to another or by producing a reaction by changing the direction of flow of a fluid stream. The terms used to define the two systems – *hydrostatic* for the former and *hydrokinetic* for the latter – sometimes confuse non-specialists because the term 'static' seems inappropriate for a system in which oil may perhaps be circulated at the rate of 100 gallons per minute. Therefore it may be useful to define a *hydrostatic* system further, as one which can develop a force at the output end without the fluid having any velocity.

The significance of the term 'static' is more readily appreciated by considering the operation of a very simple hydraulic transmission: that incorporated in a manually-operated hydraulic jack. If, with the system fully primed, the handle is depressed, a load may be lifted and held with no further movement except that necessary to compensate for any leakage past plungers. Thus force is transmitted without imparting velocity to the oil, which is a truly static state of affairs. If, now, the handle is power-operated and a considerable flow of oil obtained, considerable power may be transmitted through the system, but the underlying force relationship remains essentially what it was with no oil flow and thus the use of the term *hydrostatic* to define a system of this type is entirely defensible.

In practical terms, a hydrostatic transmission consists of a pump driven by a prime mover of some sort delivering oil through pipes or passages to motors connected to whatever it is required to drive. The component parts of a system are the pump, the motors and the hydraulic circuit.

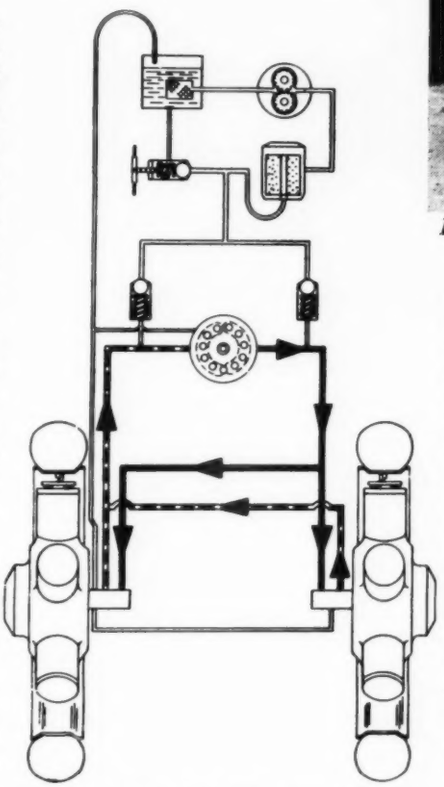


Fig. 2. The hydraulic circuit shown diagrammatically

Points in favour

The reasons why a hydrostatic transmission is particularly suitable for tractors are: firstly, the speed of the tractor can be adjusted to any desired value from zero to the designed maximum and can be changed while in motion; secondly, as there is no rigid mechanical connection between the power unit and the driving wheels, the layout of the tractor can be more in accord with agricultural requirements than is possible with a mechanical transmission; thirdly, the transmission is practically immune from damage as a result of overloading or inexpert handling.

There are a number of incidental advantages. For example, it would be

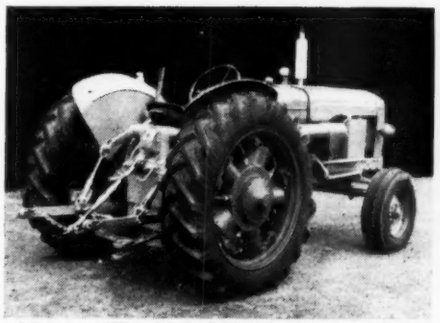


Fig. 1. The N.I.A.E. tractor equipped with 3-point linkage

comparatively easy to provide a hydrostatic drive to a steered wheel and thus the development of 4-wheel-drive tractors is a fairly straightforward proposition. This may be of more immediate interest in the field of large tractors used for earth-moving and, in this field, the hydrostatic transmission has an obvious application to large tracklaying tractors. Additional points in favour of hydrostatic drives used this way are that all clutches, main and steering, are eliminated and there is no need to use an engine with a large torque back-up.

The N.I.A.E. tractor

The starting point of the N.I.A.E. investigations into hydrostatic transmission was motor design and the work was limited to his aspect of the problem until experiments had shown very clearly that there was a good chance that a suitable motor could be developed.

Two points needed an answer. One was whether the cyclical speed variation of a motor of the type described would be noticeable to the operator. Another was whether the control would be sufficiently positive and direct The tractor that resulted from this decision is shown in Fig. 1.

The hydraulic circuit

The circuit is shown diagrammatically in Fig. 2. The two motors are connected in parallel to the pump in a closed circuit, *i.e.* there is a direct, full-flow connection from pump

to motor and from motor to pump, considering each motor separately. A small pump is provided to draw oil from a make-up tank and pump it, through a filter, into the low-pressure side of the main circuit. Excess oil from this boost pump returns to the make-up tank through a relief valve, the pressure setting of the relief valve determining the pressure in the low pressure side of the main circuit. Either side of the main circuit may be the high pressure one, depending on whether the tractor is going forwards or backwards and whether it is pulling or over-running, and means has to be provided for the boost pressure to be applied, automatically, to the low pressure side. Oil leaking from the main circuit into the pump and motor casings is allowed to return to the make-up tank.

In the circuit used there is no differential regulation of the flow from the pump to the two motors. The flow from the pump comes to a Y-joint and each motor can take the amount it requires. The effect is precisely the same as with a differential gear in a conventional transmission.

The chassis and controls

The tractor was designed to use as many components as possible of a standard machine. A New Fordson Major diesel-engined tractor was taken as the basis of the design because it could be easily adapted. By interchanging the conventional front axle and radius rod locations the power unit has been brought forward approximately to a point of balance about the front wheels. The blank nearside of the engine has been utilised as a location for the N.I.A.E. pump, a chain drive being taken from the crankshaft. A plate bolted to the flywheel housing flange carries the chain drive to the pump and the various components of the boost circuit, including the boost pump which is mounted on the end of the crankshaft and driven direct from it. The remainder of the tractor consists of two tubular side members leading to a fabricated and bolted rear frame. The oil pipes to the motors pass through the tubular side members, as can be seen in Fig. 3. There are three pipes connected to each motor, two to carry the main flow of oil and a third, much smaller, one to carry the leakage oil to the make-up tank.

The free space available with this form of construction is clearly shown in Fig. 3, but it must not be forgotten that this is a bare tractor without power take-off, belt pulley, hydraulic lift, 3-point linkage, power-assisted steering or parking brake. The two controls are placed within easy reach of the driver but out of the way, one on each side. The one on the driver's right controls the engine governor. The one on the left controls the pump tilting box; the connecting rod passes through the nearside tubular side member.

When the pump control lever is in the mid-position the tractor is stationary, when it is moved forward the tractor moves forward, and when it is moved back from the mid-position the tractor moves backwards.

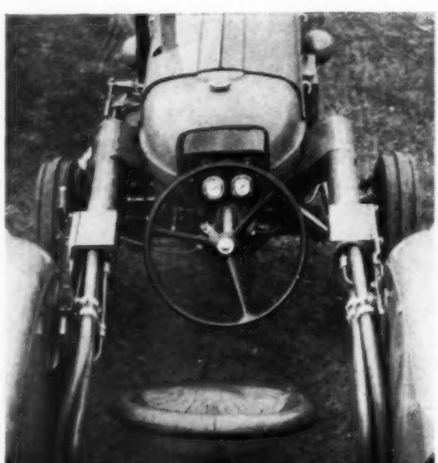


Fig. 3. The tractor chassis and controls

A standard hydraulic lift and 3-point linkage can be fitted to the tractor when required. This can be seen in Fig. 1 which also, incidentally, shows the make-up tank, mounted on the off-side of the tractor engine. The lift assembly incorporates a p.t-o. shaft and is driven by means of a shaft coupled to the rear of the main pump drive shaft. This assembly is a complete unit which is only fitted when mounted equipment is to be used. When the tractor is pulling a trailer or trailed implement the lift assembly is removed so that the operator has the advantage of being able to mount and dismount with ease.

Performance

Practical operation of the N.I.A.E. tractor has shown that the theoretical advantages of a hydrostatic transmission work out most impressively in practice. As long as the hydraulic circuit is kept free of air, the control is very positive, extremely effective and utterly simple to use. It has been found that both experienced and inexperienced drivers adapt themselves to the tractor in a matter of minutes and it has been interesting to note how an experienced driver almost immediately starts to take advantage of the possibility of changing speed while on the move, with the result that he achieves a remarkably high rate of work, particularly on a job such as ploughing a field where the soil resistance is very variable. One feature of the tractor that often gives rise to favourable comment is that, as long as the engine is running, brakes are not required so that the operator has no need to perform two operations when stopping, even with a load behind.

Operating a hydrostatically propelled tractor, in summer or winter, has been found, in practice, not to present any difficulty.

Abstracted, with permission, from the *Journal of the Institution of Agricultural Engineers*, 1956, **xii**, No. 3, 10.

Technical News

Articles appearing in the April issue of some other journals of the Leonard Hill Technical Group include the following:

Fibres 'Developments in Textile Machinery', 'Textile Industry in Israel—2' by S. Shloimovitz, 'Fibre to Yarn—Processing of Orlon'.

Manufacturing Chemist A special issue on Laboratory Furnishing and Equipment, will also contain progress reports on Analytical Chemistry, Pest Control Chemicals, Perfumery and Essential Oils and Detergents and Detergency.

Food Manufacture 'Launching a New Food Product', 'Rapid Techniques in Industrial Microbiology' by R. S. M. Charlett, 'Dairy Products' by E. J. Mann.

Chemical & Process Engineering 'Safety with Organic Chemicals', 'Chemical Engineering and Fire Hazards', 'Chemical Engineering in Canada'.

Land Utilisation in Britain

A symposium on the ' Biological Productivity of Britain ' was arranged recently in London by the Institute of Biology. The chair at the opening session was taken by Prof. H. D. Kay, who emphasised the importance of the conference. ' This symposium is not merely interesting to scientists ', he said, ' it is of vital importance in the determination of national policy. The subject is important today, but it is going to be of increasing importance in the future. The reason is the steady increase in population in Britain, coupled with the fact that with the increase in world population, less and less food will be available from countries overseas. Also the cost of this imported food is increasing – a fact which will have tremendous economic consequences '.

The opening address was given by Lord St. Aldwyn, who, ' speaking as a layman ', said: Despite its differentiation, conclusions reached in one branch of science lead to developments in another. This inter-relationship of the various branches of the sciences means that science can advance if scientists can get together for the interchange of ideas. The function of the Institute of Biology is however not merely catalytic, it is also having a growing influence on agricultural policy in Britain.

Many scientists look askance at politicians and think that their conclusions are too rough and ready; some think governments are restrictive and no not understand the work of the scientist (laughter). The Government does realise the value of science and recognises that scientists do need the freedom and the money to develop their work. All political parties, he concluded, are agreed on the need to develop agriculture to increase the productive capacity of Britain.

The ' Horndraulic ' shredder being used in the reclamation of fern-covered moorland

The Land-use Pattern of Britain, *by L. Dudley Stamp, London School of Economics, London.*

In the 1930s a voluntary organisation, ' The Land Utilisation Survey of Britain ', began a field-to-field survey of the then existing use of land in England, Wales and Scotland, and afterwards extended its work to the Channel Islands and the Isle of Man and, later still, to Northern Ireland. The main island of Great Britain, the greater part of the work, was completed in the seasons 1931–33

The classification adopted was a factual one which can be readily observed by partially trained observers. The categories distinguished are:

A: arable; M: meadow or permanent pasture; H: heathland, moorland, and rough pasture; F: forest and woodland, divided in the original survey into a number of categories; G: gardens, including allotments, and generally used where houses have a density of not more than 12 to the acre, leaving a certain tract of land which is capable of being cultivated for fruit and vegetables; O: orchards, distinguished on all the published 1-in. maps except some of the earlier sheets, where they are usually indicated on the Ordnance Survey maps; W: land agriculturally unproductive, being land closely covered with buildings, or works, or land which is definitely derelict and lying idle, and is not productive at all.

Since 1870, when the Ordnance Survey was making its first 6-in. maps, there has been a remarkable stability of land use both on the lands that are intrinsically best and in those that are intrinsically poorest; the maximum of change has occurred on land of intermediate quality. The fight against moorland causes the edge to move up the hills in times of high agricultural prices; thus land is abandoned, when prices fall, and the moorland edge then moves down.

On the whole it is remarkable how little the pattern has changed in the last 100 years, except in one particular, the relationship between arable land and meadow or permanent pasture. There has also been a steady increase of the urban areas stretching into and extending over the old rural agricultural pattern. This movement was heightened in the period between the wars when the Survey was being carried out, because of the increased standard of living which demanded towns of garden-city type. The correlation between the distribution of moorland rough pasture on the one hand and the map showing elevation on the other is really quite remarkable. Scarcely less marked is the influence of climate, particularly of rainfall. One can divide the country into three rainfall areas – the eastern part where although the average rainfall is below 30 in. a year there is usually adequate moisture for the growing of all crops, and also adequate sunshine for the ripening of cereals. Over the great area of the Midlands and the lower slopes of the

hills in the west the rainfall is between 30 and 60 in. a year and gives conditions which can be well utilised in the growing of fodder crops of hay and grasses. This area of intermediate rainfall was mainly under permanent pasture in the 1930s. Where the rainfall is over 60 in. it can truthfully be described as excessive, and there is the constant struggle against acidity resulting from poor drainage; most areas of this sort are occupied by rough grazing of one type or another. Certain agriculturists contended that it was only possible to divide land from the agricultural point of view into good, medium and poor; the soil-scientists had classifications, based particularly on soil and site; and the members of the Land Utilisation Survey used all the different considerations, including the historical survey of land use. Eventually, a scheme was agreed as follows:

Major Category I – Good quality lands. 1, first-class, capable of intensive cultivation; 2, good general purpose farmland; 3, first class, but with high water table; 4, good but heavy land.

Major Category II – Medium quality lands. 5, light land, usually with thin soils; 6, medium general-purpose farmland.

Major Category III – Poor quality lands. 7, poor quality heavy land; 8, mountain land; 9, poor quality light land; 10, poorest land, agriculturally of little use, *residue* – closely built over.

If we equate the average improved farmland to one Potential Production Unit per acre, the finest agricultural lands would have a ranking of about 2 PPU per acre, the poorer lands of the west country, that is Categories 5 and 6 of the scheme given above, about 0.5, and the rough grazing moorlands about 0.1. If a new town requires 5,000 acres, and is sited on the very finest agricultural land, it will rob the country of 10,000 units of potential production. On the other hand, if it is located on the rather poorer agricultural land the loss is only 2,500.

Taking mankind as a whole, it requires in temperate latitudes approximately 1,000,000 calories per annum to support in health a human being of the average weight of the European. This we may call one million units of gross production, or allowing 10% loss in cooking and waste in consumption, an average of 900,000 units per year, which gives an intake of 2,460 calories per day. Since it is possible to get the calorific value of almost any crop, one can tell then the carrying capacity of land in terms of food for human beings. What, of course, one finds is that, where the diet is very largely based on meat and milk, it is extravagant, and 2 or 2½ acres may be needed to support one human being on this basis.

Present Agricultural Production

by H. G. Sanders, Ministry of Agriculture, Fisheries and Food, London.

The estimated total value of agricultural output in the U.K. for the year ended 31 May, 1957, is given in Table 1. The figures bring out the big part that animals play in British agricultural production though, of course, they make no comparison of the importance of crop and of animal husbandry, since much of the country's crop produce is fed to livestock and marketed in animal form. Government support in the form of price guarantees and production grants amounted to some £245 millions and the total income of farmers was forecast at about £317 millions.

Throughout recorded history there has been advance, halting at times but always resumed and ever onwards, in yield of crops per acre. From figures which Sir William Gavin produced it seems that the average yield of wheat has risen by about 2¼ cwt. an acre in each century since 1350 and this rate continued till 1939. Since then the increase has been 4½ cwt. an acre – two centuries' worth of gain in a decade and a half. The average yields pre-war and today for the main arable crops are given in Table 2.

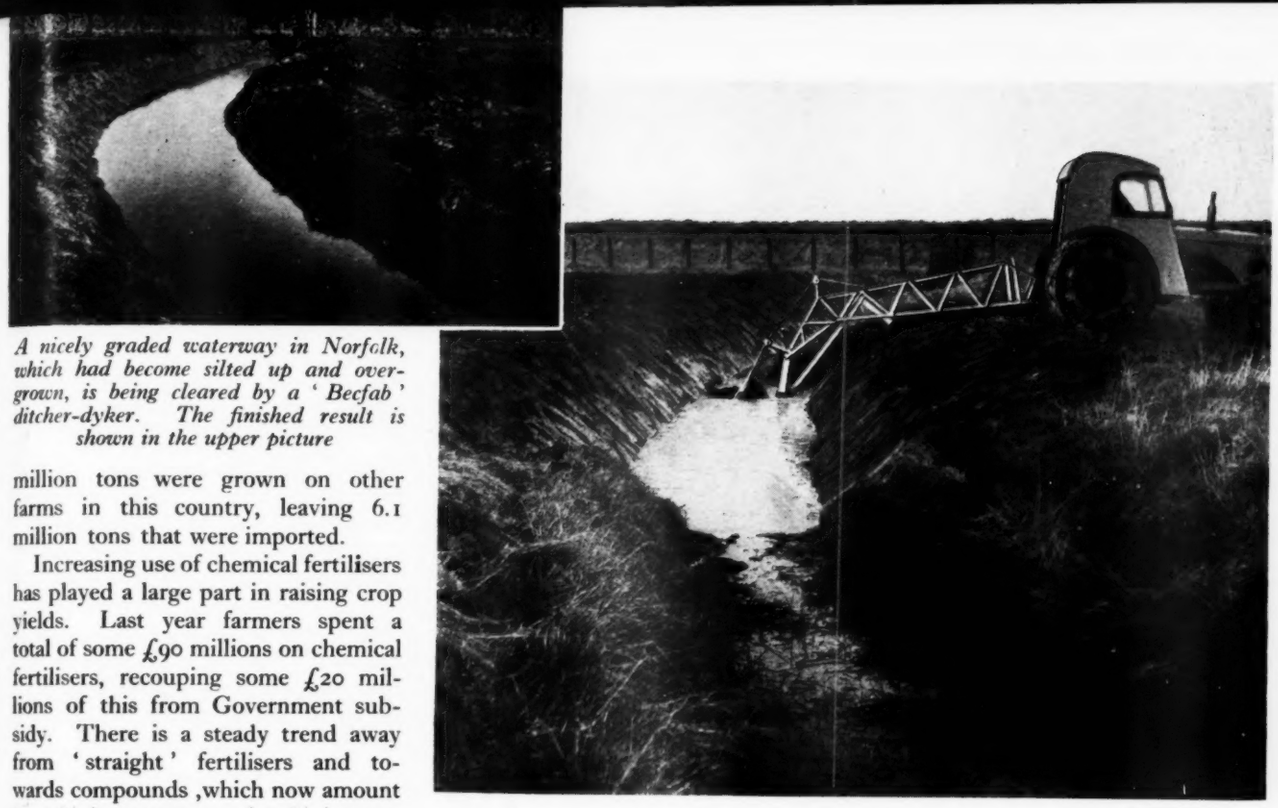
The total labour force in British agriculture today is not very different from that in 1939 but these 18 years has seen the virtual disappearance of working horses, whose numbers have declined from 724,170 to 147,300, and an increase in the number of tractors from 46,000 to over 400,000. Mechanisation has played a big part, of course, in increasing the productivity of labour but it has entailed heavy annual expenditure by farmers. Another input of British agriculture which involves farmers in heavy expenditure is concentrated foods for livestock. The total amount used by farmers was 12.3 million tons, of which 3 million tons were grown on the farm on which they were fed. A further 3.2

Table 1

	Value	(*£ million*)
Cereals	145	
Potatoes	56	
Sugar-beet	30	
Other farm crops	10	
		241
Milk and milk products	354	
Meat	433	
Poultry and eggs	183	
Other animal products (mostly wool)	17	
		987
Fruit	41	
Vegetables	69	
Other horticultural products	20	
		130
Valuation changes etc.		17
		1,375

Table 2

	1937-39	1954-56
Wheat (cwt. per acre)	18.5	24.7
Barley (cwt. per acre)	16.8	23.8
Oats (cwt. per acre)	16.4	19.8
Potatoes (tons per acre)	7.1	7.7
Sugar-beet (tons per acre)	8.4	11.1



A nicely graded waterway in Norfolk, which had become silted up and overgrown, is being cleared by a 'Becfab' ditcher-dyker. The finished result is shown in the upper picture

million tons were grown on other farms in this country, leaving 6.1 million tons that were imported.

Increasing use of chemical fertilisers has played a large part in raising crop yields. Last year farmers spent a total of some £90 millions on chemical fertilisers, recouping some £20 millions of this from Government subsidy. There is a steady trend away from 'straight' fertilisers and towards compounds ,which now amount to 59% in tonnage, and 70% in cost, of all the fertilisers purchased. The last available Trade Returns (for 1955–6) give the deliveries shown in Table 3.

Two fundamentals of soil fertility are liming and drainage. In regard to the former the position is fairly satisfactory. The position with regard to drainage is not so good. The most serious failing is in the maintenance of ditches; it is estimated that only about half of these are kept in good condition and the wet weather of February and March, 1957, showed up the land that is suffering in consequence. Efforts are being made to produce a machine that will deal cheaply and efficiently with farm ditches, to save the heavy hand labour otherwise required.

The agricultural production of any country is unlikely to approach its full biological potential because of economic factors, and this is certainly true of the U.K., the centre of a world-wide Commonwealth. Agricultural policy in this country must take some account of the marketing needs of other members of the Commonwealth. The present total agricultural production appears to be about the level which best suits the country; it avoids too great reliance on imported food but it leaves room for imports, particularly from other members of the Commonwealth, to pay for Britain's manufactured products.

Table 3

	Thousand tons
Sulphate of ammonia	222
Other nitrogenous fertilisers	439
Superphosphate	135
Rock phosphate	37
Basic slag	712
Other phosphatic fertilisers	34
Potassic fertilisers	43
Total straight fertilisers	1,622
Compounds	2,302
All chemical fertilisers	3,924

The Recent History of Land Use

by G. P. Wibberley, Wye College (University of London), Ashford, Kent.

In broad terms, people in Britain, as in other countries, use the surface of their land for the purposes of agriculture, forestry and recreation, or merely as a site. Agriculture is by far the biggest use in all countries if we ignore the vast areas of ice, tundra, mountain, forest and desert which man has left all but unused. Even in a heavily industrial country, such as Britain, land in farming use takes up more than four-fifths of the total area. Forest land is usually the next in importance though its area, either in natural or planted woodland, varies greatly between different countries. In Brazil, for example, it covers nearly three-fifths of the total area of the country, whilst in the U.S.A. it is about one-third and in the U.K. less than one-fifteenth. Land for recreational purposes becomes important in societies which have reached a fairly advanced level of social control and where most of the inhabitants live in cities or towns. The main uses of land in England and Wales are shown in Table 4.

Between 1900 and 1950, the area under agricultural uses, as recorded in the Agricultural Statistics, fell from 31,050,000 to 29,920,000 acres and, as a proportion of total land surface, from 84% to 81%. The non-agricultural area during this period has expanded by a like amount, the urban area having increased from about 2,000,000 acres in 1900 to 3,600,000 acres in 1950. At the same time the area under woodland has increased from some 1,900,000 acres to 2,320,000 acres.

A swampy area being reclaimed by drainage, using a ' Shawnee ' digger

These changes are shown in Table 5.

It will be seen that the fall in the area under crops and grass has been sharp, the reduction in permanent grass being the main reason for it. The arable and tillage acreages declined in earlier years but have since expanded in the years during and following the second world war.

More recent changes in the areas under individual crops show a wheat acreage which has levelled off somewhat above that of 1938, an oat acreage which has declined sharply from its war-time peak, and a steady and spectacular rise in the area under barley from one million acres in 1938 to approximately two and a quarter million in 1955.

A glance at the figures for root crops, which, it must be remembered, are heavy users both of human labour and of machinery, shows that the potato acreage since 1938 rose sharply during the war but has declined to its pre-war level at a slower pace. The area under turnips, swedes and mangolds continues to decline because less costly and more labour-saving methods of producing livestock feed for the winter months have been discovered, particularly by the preservation of grass in one form or other and by the use of kale. The area under sugar-beet maintains its small but significant place in British arable districts.

Despite oscillations due to weather, there has been a significant increase in the yield of cereals in this country. The trend-line shows an increase of about 4 cwt. per acre between 1926 and 1956, and this increase is due to the skill of the plant breeder and improved and wider knowledge of cereal cultivation and of good fertiliser practice. The physical productivity of arable land has shown a definite movement upwards, the index moving from 100 in 1926 to 120 in the 1950s.

Farms of under 50 acres take up less than 20% of the agricultural area of the U.K. This may be compared with the proportions in other countries: Denmark, 40%; France, over 50%; Netherlands, 60% and West Germany, nearly 70%.

Two important categories of land-use remain. The first is woodland, and the second is the area of land unaccounted for or in special uses. Woodland itself in 1950 took up 2,322,000 acres in England and Wales or 6% of the land area. In Great Britain the 3,620,000 acres also form about 6% of the total land area. Since 1900 the area under woodland has grown in Great Britain from 2,770,000 to 3,620,000 acres, an increase of 31%.

Land which is unaccounted for or in special uses defying more general classification is thought to have decreased from just over 2,000,000 acres in England and Wales in 1900 to 1,250,000 acres in 1950, and in Great Britain as a whole from under 6,000,000 acres to about 3,250,000 acres in 1950, these figures including ungrazed deer forest in Scotland.

To Authors and Readers

The publishers of WORLD CROPS invite the submission of manuscripts of books to be considered for publication. All manuscripts will be promptly acknowledged and carefully considered by qualified experts. A synopsis with chapter headings should be sent in the first instance, addressed to the Book Production Manager.

The publishers are specialists in industrial, technical and scientific books.

Table 4
The main land uses of England and Wales
(thousand acres)

Year	*Agri-culture*	*Wood-land*	*Urban develop-ment*	*Un-accounted for*	*Total land area*
1900 ..	31,050	1,900	2,000	2,180	37,130
1925 ..	30,780	1,880	2,300	2,170	37,130
1935 ..	30,380	2,120	2,800	1,830	37,130
1939 ..	30,180	2,290	3,200	1,460	37,130
1950 ..	29,920	2,320	3,600	1,290	37,130

Table 5
Changes in the agricultural area of Great Britain
(thousand acres)

Cover	1900	1917	1935	1944	1950
Permanent grass ..	16,729	17,251	17,174	10,809	11,685
Arable	15,708	14,607	12,381	17,936	17,159
Crops and grass ..	32,437	31,858	29,555	28,745	28,844
Rough grazings ..	12,903	13,183	15,803	16,327	16,395
Total agricultural area..	45,340	45,041	45,358	45,072	45,239

Taming the Barren Lands

Australia's 'Ninety Mile Desert'

Virgin desert scrubland before it has been brought into the new scheme

FIVE years ago, the Australian Mutual Provident Society put into operation a huge land development scheme – possibly the biggest of its kind in the world – to assist the pioneers of this generation to become the owners of their own farms. The scheme will eventually provide for the establishment of 80 farms on a huge tract of hitherto barren land known as the 'Ninety Mile Desert', which lies on both sides of the Adelaide–Melbourne railway line, not far from the Victorian State border.

Today, where bulldozers nose their stubborn way through mallee, heath and stringy bark, dragging the roots across the clay-foundationed sandy soil, early settlers cleared land with strong arms and sturdy horses. They planted seed and watched in vain each year for an improvement in the crops. Year by year, however, and in spite of an adequate rainfall of 16–20 in. a year, the wheat and oats crops grew poorer and the sheep lost condition, produced sub-standard wool and few lambs. The farmers found it impossible to continue: they had done their best, but the 'desert' had defeated them.

As a result of the work of the C.S.I.R.O., it was discovered that to convert this land from barrenness to fertility, it was necessary to add to each acre less than 4 lb. of copper and zinc, in addition to the major fertilisers normally applied.

At this point the Australian Mutual Provident Society stepped in and acquired an option from the Government on more than 500,000 acres of these barren lands. The farmers who joined the scheme were given a farmhouse and other facilities, and a basic wage; in return all the money they can spare goes towards paying back the purchasing price.

The task of tackling the near-worthless scrub and changing it into healthy pasture was soon under way. So hard and willingly have the participating farmers worked that already this pasture provides adequate grazing for 20,000 sheep and 3,000 cattle, and fat lamb raising, wool growing and beef production are showing results that are more than satisfactory.

From the inception of the scheme, Lister machinery has played an important part: lighting sets, sheep shearing equipment and industrial engines for pumping, irrigation, milking machines, timber cutting, and other essential machines are all in use on the new farms that are gradually spreading into the 'desert'.

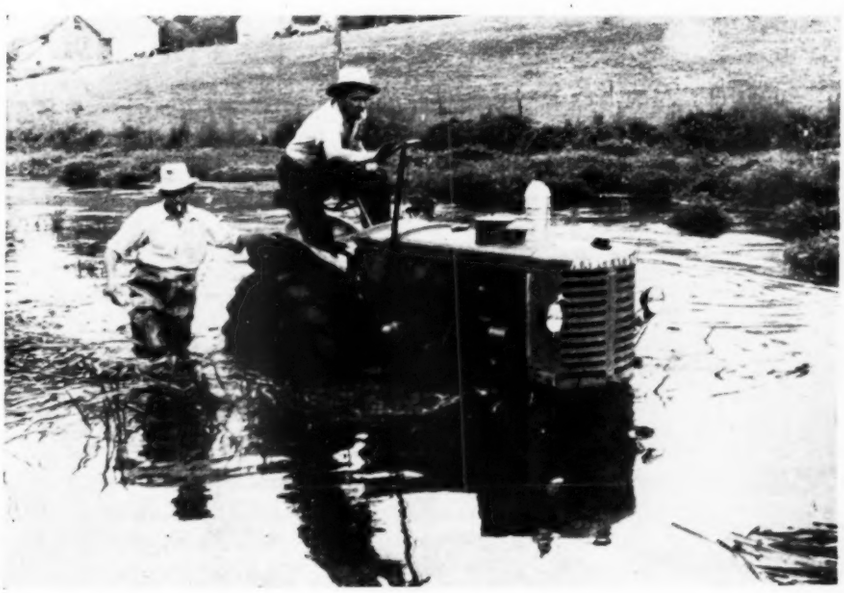
For Clearing Reeds

Clearing rivers and ponds in the Dijon district of France is an annual problem for property owners. Reeds usually have to be cut by hand, and the men are obliged to spend long hours in the water.

As an experiment, a land-owner asked the Renault organisation to see if the reeds could be mowed by tractor.

A standard Renault tractor, powered by a Perkins diesel engine, took to the water, without any special preparation, in the River Baize, a stream popular among French fishermen.

At times half submerged, rolling and pitching on the uneven river bed, and throwing out cascades of water from its fan, the tractor cleared the river in a few hours. Then, dripping with water and covered with mud, slime and weeds, the tractor was driven off as quietly as it if had just mowed a field of lucerne.



A helicopter applying the new weedkiller for general weed control in cereals

Evolution of a New Weedkiller

GORDON WRIGLEY, B.SC., A.I.C.T.A.
(Chesterford Park Research Station)

Many important advances in science, such as the discovery of penicillin, have resulted from chance observations; here is yet another.

THE post-war world has seen the rise of a new species of scientist, the weed control worker, to whom small field plots are as the test tube is to the chemist. A casual observer may notice little, if any, differences between trial plots, but to the weed control worker small differences stand out and may be very significant.

The chance observation

Dr. Pfeiffer was once showing some colleagues at Chesterford Park a series of small plots, where he had made a negative observation. The ubiquitous and persistent weed, *Galium aparine*, known across the wheatlands of Britain as cleavers, goosegrass, scratch grass and a variety of other names which illustrate both its wide distribution and serious nature, had ceased to grow in certain of the plots. The doubting Thomases present were convinced it was the drought, the cold spring or other physiological factors, unconnected with the treatment; after all, the charlock in these plots, they observed, seemed quite healthy and charlock is known to be very susceptible to plant growth regulators.

Death to cleavers

These cleaver-free plots had been treated with a very low dosage rate of polychlorobenzoic acid, a chemical which had been reported on in the U.S.A., but one that had still to find a place in the farmers' calendar. At first the cleavers had looked quite normal but it was obvious to the field workers who observed them every day that these weeds had stopped growing the day that they were sprayed.

For a while, doubt and debate remained, until it became clear that the cleavers were certainly not normal. The new leaves remained small and close to the stem; the growing point became more apparent, changing its appearance until the plant looked more like a horsetail, *Equisetum* spp.; then it grew out in a last desperate thrust, blackened, and finally died. This was the first time that anyone had seen cleavers killed by a hormone type of weedkiller – or, at least, so it was believed.

By a strange coincidence, however, a similar group at Nottingham must have been watching a completely different chemical perform the same feat, each group completely unaware of the other's work. A ten-year search for a non-toxic hormone-type herbicide for cleavers was nearing its end.

When the same chemical was sprayed again, the results were perhaps a little disappointing, because although the cleavers were again controlled, a number of the common weeds, such as charlock, still persisted, as in the original trial. Nevertheless this provided a complete confirmation of the original observation.

Various formulations

Fortunately about this time, Chesterford Park had perfected the Logarithmic Sprayer, see WORLD CROPS, 1957, **5**, 204; amongst other feats it could spray one chemical at a constant concentration and decrease the chemical dosage of a second chemical logarith-

mically, spraying the two together as a mixture. By using polychlorobenzoic acid and MCPA in this experimental spraying machine it soon became obvious that the two chemicals used together could control a wider range of weeds than each individually and also that they had a synergistic action on each other, so that surprisingly low rates of each were needed for adequate weed control.

Meanwhile the synthetic chemistry section had prepared various other chlorinated benzoic acids and the botanists had evaluated their activity. Again, by using the logarithmic sprayer, combinations of two or more of these chlorinated benzoic acids with MCPA could be sprayed experimentally, and thus the optimum combination was finally established.

Toxicity studies were also carried out on the ingredients selected and they were shown to be free from hazards to spray operators and farm animals. Formulation chemists mixed in various additives until they were sure that it could be sprayed in low volume with hard water, without fear of nozzle blockage, and that when tested on the droplet machine, it performed as a low-volume spray should.

Statistical plot trials

Finally a formulation, CP1815, was ready for accurate field testing in a series of replicated statistically-designed yield trials, which showed that whilst this formulation gave the usual increase in yields when sprayed on weedy cereals, there was no adverse effect which would reduce yields of the cereal in the absence of weed competition. For the weed control research worker in Britain, the winter is rather frustrating. When the previous summer's results are worked out apart from greenhouse trials– which can be misleading – he can only plan work for the next season after the snow has cleared. In this case, however, supplies of CP1815 were sent to Africa and New Zealand so that investigations could go on.

Preliminary field trials

In Kenya, the problem of 'hormone-resistant' weeds among the varied flora of the Highlands has become of increasing importance in the last few years, as the continued use of MCPA and 2,4–D reduced the competition to the resistant weeds and had enabled them to become dominant. The 'local' cleaver is *Galium spurium* and this was found to be controlled by CP1815 just as well as was the British species. The wet acid conditions of the Kinangop favour the dominance of spurrey, *Spergula arvensis*, which forms a thick tangled mat. Whereas MCPA, 2,4–D and polychlorobenzoic acids, each used alone, only check its growth, the new formulation gave a very good kill.

A species of *Malva* similar to mallow, which fortunately does not trouble British farmers, causes problems in most of the cereal areas at harvest, due to the tough thick stems which damage the cutter bars and choke up the combine-harvesters. Even the small seedlings are resistant to the dinitro herbicides, and 2,4–D or MCPA alone has no effect on them. CP1815 prevented the flowering stem of *Malva* shooting and the harvest could then go ahead, unhindered.

In the Nakuru-Solai areas the Cape Gooseberry, *Physalis angulata*, which produces a profusion of seeds, has become a serious pest of maize and other cereals. This was also found to be susceptible to CP1815. Though this new product controls a much wider range of weeds in the Kenya Highlands than any previous selective herbicide, there remain a few important weeds which still cannot be controlled satisfactorily, including *Oxalis*, *Commelina*, and a local *Cyperus* species.

Meanwhile workers in New Zealand had become so interested in this new product that they tried it on a wide range of crops. They confirmed previous findings that it could not be used on peas and clovers, but they found it could be quite effective in getting rid of bad weeds in poor pastures, in addition to its use on non-undersown cereals.

Cleavers and mayweed infesting a crop of wheat which has not been sprayed

(Left) A clean stand of wheat six weeks after the crop had been sprayed with the new weedkiller

Large-scale field trials

Despite the large amount of evidence now available it was decided that the new formulation should not be offered to the farming community until a further year of intensive testing had been carried out, for which large quantities of the product would be required.

So the year 1957 witnessed the biggest development campaign in the history of the company. The problems of preparing organic chemicals in a laboratory are not infrequently difficult but the problems of production in a pilot plant are considerably greater. All the development plan rested on the chemical engineers being able to produce the amount of product required, at the correct time, and according to the required specification, largely with the equipment they already possessed. Fortunately the first batch was finished on the required day and the schedule was kept in quality, quantity and time.

The effect of CP1815 on crop yield is of vital importance and 30 large-scale field trials could now be laid down to compare it with MCPA, 2,4-D, CMPP and DNC. Yield increases of over 20% were obtained in weedy cereal crops, and its complete safety, when applied at the correct time, was shown in the weed-free sites.

With the very generous co-operation of farmers, sites on about 100 farms throughout the U.K. were sprayed with CP1815 and other chemicals to prove its capabilities on the widest range of soils and climatic conditions. Where spraying had previously been carried out for a number of years, weeds such as cleavers, chickweed and mayweed were of greater importance than poppy and charlock. The wider weed spectrum of CP1815 was very obvious but the strips sprayed with MCPA alone were often an embarrassment near harvest time as the cleavers came through the top of the crop. The logarithmically-sprayed strips showed the effects of both under- and over-dosing on crop and weed with the new product.

A milestone

Many progressive farmers, particularly in Wiltshire, believe that helicopter application of herbicides gives the highest yield increase due to a combination of excellent weed control helped by the downdraught effect, and the elimination of the crop damage which occurs where the tractor travels through the crop. Fison-Airwork kindly offered the services of one of their helicopters to carry out aerial application trials, using four pints CP1815 in three gallons of spray per acre. It was very encouraging that this new product gave excellent weed control when applied by helicopter. This, incidentally, was the first known case of cleavers, chickweed or mayweed being controlled from the air – a milestone in crop protection.

Crop safety

The final evidence came from the laborious job of analysing the samples of heads of wheat taken from the plots in twenty 5-acre trials, sprayed at different development stages. Although ear deformities do not necessarily mean reduced yield, they are much more apparent to the farmer, and these trials finally proved the safety of the product, because no deformities occurred when the product was applied at the correct development stage.

Trials in Europe

During the same summer, our associates in various parts of Europe had also been testing the product, because weeds resistant to MCPA and 2,4-D were gaining in importance in their countries. In many parts of Sweden mayweed is serious, in Denmark persicaria, *Polygonum persicaria*, and in Germany in an effort to control *Galinsoga parviflora*, farmers were spraying mixtures of 2,4-D and 245-T.

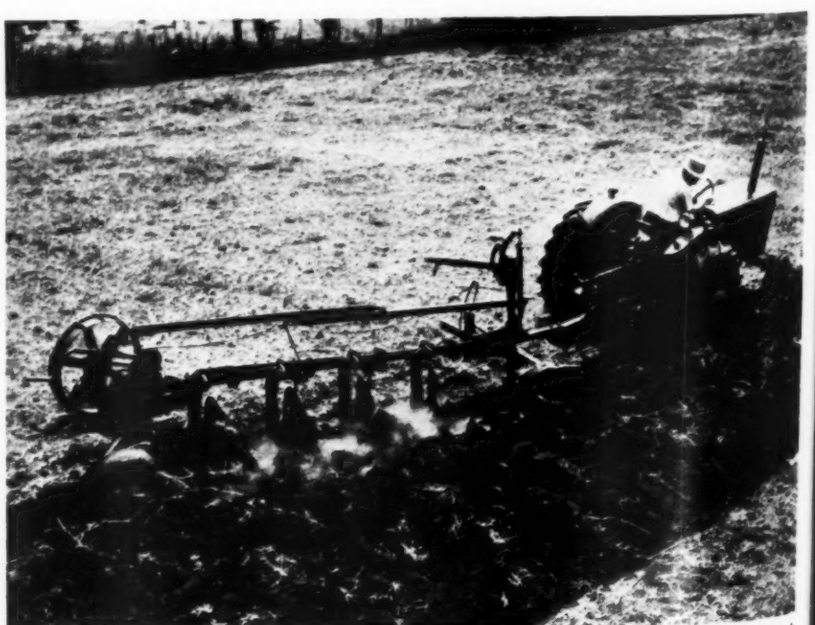
When used as suggested, results all round were encouraging; the great disappointments came when they found it reduced the flowering of flax or severely damaged peas. In Holland, it gave a remarkably good control of cleavers.

Trials in the tropics

Enquiries have been received from all parts of the world, from rice growers, sugar-cane estates, coconut planters, scientific workers and crop research stations, all with weed control problems and all hoping that this new discovery could help them. There is little doubt that it will find a place for the control of broadleaved weeds in graminaceous crops such as paddy, and samples have been sent out for testing on various tropical crops, but it is too early yet to assess results.

The product had now been thoroughly tested and proved, and the decision was finally made to offer it to farmers as Fisons 18-15.

A Severe Test



During a recent demonstration near Nakuru, East Africa, the 30-b.h.p. International Harvester B-250 pulled a four-furrow disk plough at 11 in. depth in second and third gear. This is a severe test of the weight distribution and hitch design

Correspondence

The Language Barrier

The Editor,
WORLD CROPS,
9 Eden Street,
London, N.W.1.

DEAR SIR,

I am writing to you in connection with the article, 'The Language Barrier', which appeared on pages 439 and 440 of the November 1957 issue of WORLD CROPS. I apologise for writing so belatedly, but my attention has just been drawn to this article, at a meeting of the London Association of Conference Interpreters.

As an experienced conference interpreter, I know that I am speaking for all my colleagues, everywhere, in pointing out the following:

(1) Recognised and experienced conference interpreters can handle the simultaneous or consecutive interpretation of any meeting, from and into any language, in a satisfactory manner. No subject daunts them; they thrive on difficulties, technicalities, etc.

(2) The special problems of the German language, to which you refer, are recognised, and there are accepted techniques for catering for them. Other languages also give rise to problems, and these, too, have long been solved.

(3) The above considerations hold generally: a fully satisfactory level of performance on the part of the interpreters, however, does also make some requirements of the conference or congress organisers to wit:

(a) When the subjects are highly technical, the texts of any available papers, abstracts, etc., must be sent to the interpreters in advance, even in one language only. The interpreters can thus study the subjects both as to their substance and as to the terminology involved. Should there be no such material available, suitable reference works should be indicated and, where possible, placed at the disposal of the interpreters.

(b) The organisers must see to it that all speakers have a reasonable rate of delivery, compatible with maintaining the audience's interest, but adapted to the nature of the linguistic problems to be solved. This is important, not only for the interpreters, but also for the large number of participants who, very often, have an imperfect knowledge of any of the official congress languages (Scandinavians, Portuguese, Italians, Spaniards, to quote but a few nationalities which were surely represented although, in this instance, English, French and German were the only languages spoken).

(c) When the subjects are very technical, it is advisable to hold 'briefing meetings' prior to the congress, at which the interpreters can be informed of some of the 'technical snags' which they will meet.

(d) No amateurs should be used. If (a), (b) and (c) are fulfilled by the organisers, experienced professional conference interpreters will do the job better than anyone else.

I have no doubt that any professional conference interpreters present at that congress would have produced highly successful results had there been this co-operation between themselves and the organisers. In this, as in so many other things, there must be give and take.

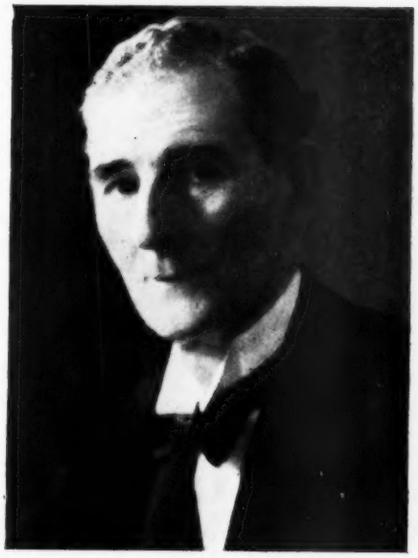
I should appreciate it if these considerations could be communicated to the organisers of any subsequent international meetings. The value of these meetings would thus be enhanced, and they could better serve their true purpose, that of providing a real *international* forum for their participants.

Yours sincerely,

(MRS.) RUTH HALL.

Further editorials on the 'Language Barrier' have since appeared, WORLD CROPS, 1958, 10, 2 and 82. Is it seriously claimed that the L.A.C.I. could deal satifactorily with the problems of technical language at conferences attended by delegates from, say, 100 countries, where there are people who speak no European language whatever? And, if so, could an ordinary scientific conference afford to pay for such are markable service?—ED.

The Exhibition



Opening by The Rt. Hon. Tom Williams, M.P.

THE Rt. Hon. Tom Williams, P.C., LL.D., M.P., has consented to perform the official opening of the first *Crop Protection* and *Pest Control Exhibition* at 3 p.m., Monday 12 May, in the Royal Horticultural Society's New Hall, Greycoat Street, Westminster, S.W.1.

Mr. Williams has sat in the House of Commons as the Member for the Don Valley for 35 years. His official connection with agriculture began in 1924, when he was appointed Parliamentary Private Secretary to the Minister of Agriculture in the first Labour Government. In the second Labour Government he was Parliamentary Private Secretary to the Minister of Labour from 1929 to 1931. In 1940, he was appointed Parliamentary Secretary to the Minister of Agriculture in the National Government and served in this post until the end of the war.

When the Labour Party gained power in 1945, Mr. Williams became Minister of Agriculture and served in this office for six years, until 1951. He thus has had longer and more continuous service in this important Ministry than any other member of the present House of Commons. After leaving office in 1951, Mr. Williams was for a time an adviser on agricultural matters to the Ford Motor Co.

New Publications

Crop Production

By H. D. Hughes and E. R. Brown. Pp. xii, 620, illustrated. New York: Macmillan Co. 1957. 48*s*. 6*d*.

This book on the principles and practice of crop production in the U.S.A. was first published 27 years ago and now appears in a revised edition, having been reorganised and completely rewritten by H. D. Hughes, D. S. Metcalfe and I. J. Johnson.

For ease of reference the subject matter is divided into unusually numerous chapters, but still follows the familiar design of books intended for agricultural students. In the early chapters the pattern of world agriculture is outlined and the position as a producer which the U.S.A. occupies is indicated. The development of agricultural science is summarised and a few short chapters devoted to basic information on plants, water, soils, cultural methods, seeds and the improvements of field crops. Apart from the final chapters concerning grain storage and marketing, plant diseases, insects and weeds – subjects which might more conveniently have been placed earlier in the volume – the ' core ' of the book may be considered under two headings: firstly, the chapters on crop production give succinct accounts of all the more important crops in the U.S.A., how they have been improved, production methods and uses. In this connection the chapters on corn are conspicuous for their clarity, particularly the exposition of hybrid vigour as related to this crop. On the other hand, one cannot help feeling that some crops receive less consideration than they deserve: tobacco, for instance, the fifth most valuable crop in the U.S.A., is dismissed in nine pages of reading matter. At least the statement regarding extension of the practice of growing tobacco on the same ground year after year is worthy of fuller discussion. Secondly, the 14 chapters devoted to pastures and forage crops give adequate consideration to the varied climatic and soil conditions met with over the vast area of the U.S.A.

The authors disclaim any intention of producing a book of encyclopædic reference; nevertheless, the staccato-like presentation of facts which is characteristic of this work gives one the impression that agricultural students will use the book to amass facts for examination purposes.

It is easy to criticise details, but one cannot cavil at the thoroughness with which the subject has been brought up to date, the excellence of the illustrations, or the wide range of authoritative information presented in this volume.

D. H. GRIST

★

Natal

Vol. 13 of the Natal Regional Survey is a Symposium of Recent Developments in Agriculture in Natal. The Survey aims at presenting a comprehensive picture of the social and economic structure of Natal as a factual basis for development programmes. After a review of the climate, soil and vegetation of the province, studies are made of the different types of farming carried on there: sugar-cane, wattle, field crops, fruits and vegetables, and livestock. Additional chapters are provided on soil conservation – soil erosion being one of the most serious problems facing Natal farmers—dairying, poultry and output and labour.

Published by Oxford University Press, price 45*s*.

★

East Africa High Commission

An illustrated pamphlet published by the East Africa High Commission gives particulars of insects that attack East African trees. Control methods to minimise the damage both to living trees and to timber are also given. Obtainable from the Forest Department, P.O. Box 30027, Nairobi, Kenya, price 1*s*.

★

Changes in the Economic Pattern, 1956-57

This new volume takes the place of the Agricultural Register, which last appeared for the year 1938-39, and is published, as before, by the Agricultural Economics Research Institute of the University of Oxford.

The book sets out the facts about the economics of British agriculture in its varied aspects and explains most of the economic changes that have occurred in British agriculture during the last year or so. It covers marketing and prices, international trade, labour, land and capital, and the economics of agricultural production and sales. This book will provide an invaluable factual background on which to judge the efficacy of present and future agricultural policy. Price 21*s*.

★

Rice Milling

FAO has published an ' Illustrated Glossary of Rice Processing Machines ', which is designed to meet the difficulties caused by the different concepts of rice milling terms in various countries. The Glossary includes drawings of the most commonly used types of rice processing machines with relevant terms and designations of the machines and their main parts, in English, French and Spanish. All references to the rice grain in the various processing stages are in accordance with the International Rice Terminology outlined by the International Rice Commission at its first session held in Bangkok, Thailand, in March 1949.

★

Cereals

The 1958 lists of varieties recommended by the National Institute of Agricultural Botany are now available.

New editions of the Institute's Farmers' Leaflets incorporating these recommended lists of wheats, barleys and oats may be obtained by sending a stamped addressed envelope, mentioning the crops required, to The Secretary, N.I.A.B., Huntingdon Road, Cambridge.

★

Other Publications

We have received copies of the following publications:

University of Cambridge School of Agriculture Memoirs, No. 29, which contains a summary of the papers published by the members of the staff of the School of Agriculture and its associated research organisations during the period October 1956 to September 1957 and includes an article by F. G. W. Jones (Review Series No. 12) on entomology and nematology in the School of Agriculture, 1899–1956.

Tanganyika Agricultural Corporation, Report and Accounts for 1955–56.

Machinery and Equipment

Housing for the Colonist

The ' Uniport ' metal building was first introduced in 1948 to meet a request for labour housing in Africa. Now thousands are being used for housing, both temporary and permanent, in all parts of the world. On land development projects, irrigation and colonisation schemes they provide offices, stores, sleeping quarters, canteens, workshops and visitors' quarters, and when the work is completed there is 100% recovery value, as dismantling is so simple that it can be effected without damage to the component parts. A useful application would be to provide housing for refugees from devastated or flooded areas.

The smallest house is 14 ft. 4 in. in diameter and has a floor space of 160 sq. ft. Larger buildings can be made to whatever length is required with the standard width of 14 ft. 6 in. They are made up of standard panels (which can be stacked flush) and windows, doors and communicating passages can be placed where required, and these fittings can be rearranged later, if required.

If more permanent buildings are wanted, hardboard linings, with battens for fixing to the wall panels, can be supplied. Similarly, a house can be subdivided into a number of rooms by means of wooden partitions. In some countries it may be more economical to have these parts made locally.

A ' Uniport ' house can be erected very quickly and with unskilled labour, using only a box of spanners. There are models in aluminium and in galvanised steel; the former have the advantage of long life; the latter, which are rust-resisting, are cheaper. All these buildings are, of course, rot-proof, impervious to insects and resistant to fire. Good ventilation is provided, which makes them suitable for use in the tropics.

Reader Service

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England

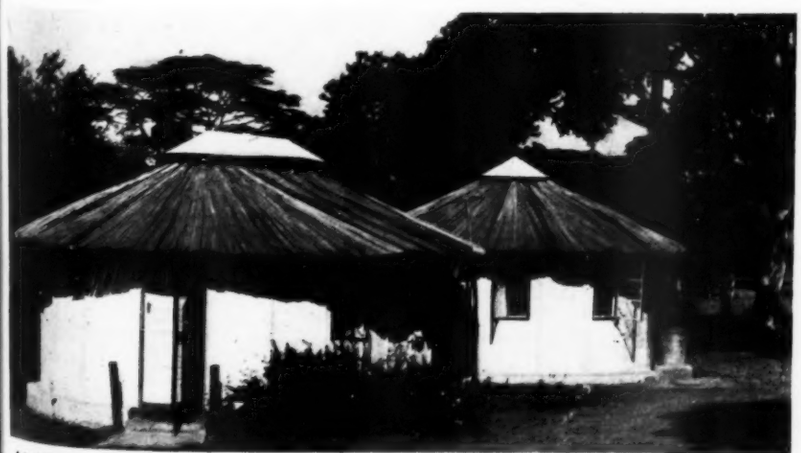
Work in All Weathers

Of course, it is wise to keep a tractor off rain-sodden land, but idle time for a tractor during bad weather is the same as capital lying idle; there are many other jobs in and around the farm – jobs of farm transport, the delivery of produce to market, the collection of farm supplies and other work which can be done, if only the driver can be properly protected. If he is protected from biting winds, lost time due to sickness can be reduced.

Weathershields all-weather cabs have been made to fit all makes of tractor, including the new Massey-Ferguson ' 35 ' and new Fordson ' Dexta '. They are of sturdy welded steel construction with good front and side vision through windows of toughened safety glass, which are mounted in rubber. The open back has a roll-up canvas curtain and is fitted with a back light for ease in reversing and backing.

Weathershields Motor Equipment Ltd. make a variety of cabs for the leading makes of tractors

The wet cultivation of paddy fields can go on whatever the weather, so that the progress of work is not checked. *This means that a much larger acreage can be cultivated with the same tractor.* The swivelling side windows can easily be removed in hot humid weather and an asbestos lining could also be fitted to the underside of the roof to give added protection against the heat of the sun in the tropics.



A ' Uniport ' oval house attached by a passage to the servants' quarters. Both houses are thatched to give additional protection against the tropical sun

Electric Fencing

Elephants, giraffes, buffaloes and baboons are among the many wild animals that have been successfully controlled by means of electric fencing. Wolseley Engineering Ltd. manufacture an electric fence that is both simple and sturdy and they will give advice on erecting and maintaining the equipment.

Posts are usually placed at distances of between 12 and 15 yd. and must be close enough for the wire to follow the

undulations of the land. At intervals of not more than 400 yd., a 'strainer' post is necessary, as the wire is strained from one heavy post to the next. The number and height of the wires depends on the species of animal it is required to keep away. Success depends on careful erection and regular inspection of the wire and it is important to keep the wire clear, as a blade of grass or overhanging branch of a tree which touches the wire can short the whole system.

New Tractor Shovels

W. E. Bray & Co. Ltd. have announced three new 4-wheel-drive tractor-shovels which are designed for work in arduous conditions.

Having rear-wheel steering, these new tractor-shovels are extremely manoeuvrable with a turning radius of under 20 ft.

The BL.440, which is powered by a Ford 4-cylinder diesel engine, has a lifting capacity of 2,800 lb., and the BL.450 and BL.450T are both powered by a Perkins 62-b.h.p. diesel engine and have a lifting capacity of 3,100 lb. The BL.440 and BL.450 machines have a standard type of transmission giving six forward and two reverse gears and a speed range of 2–13 m.p.h.

For the first time, epicyclic gear, hub-reduction units have been fitted on all axles and exhaustive tests have proved these axles are capable of withstanding the heavy shock loadings experienced in levelling and earth-moving works, as they give greater wheel pull with less axle strain.

The operator, seated in a comfortable upholstered seat, has an unobstructed view of the leading edge of the bucket while digging. The power-assisted steering, and the convenient grouping of the controls, mean that driver fatigue has been virtually eliminated.

The ' Sabredisc ' tractor-mounted harrow for heavy or light tillage operations

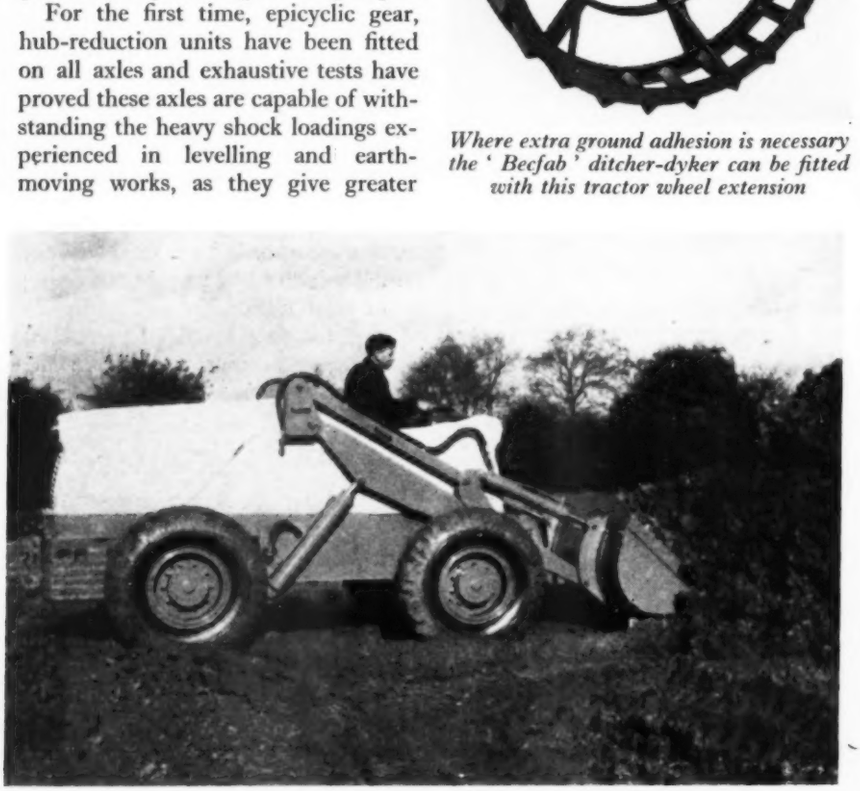
Where extra ground adhesion is necessary the ' Becfab ' ditcher-dyker can be fitted with this tractor wheel extension

For Shallow or Deep Tillage

The ' Sabredisc ' mounted disk harrow is designed for light and heavy tillage operations. It consists of four gangs of disks of hardened Sheffield steel, mounted diagonally under a welded steel frame of robust construction and fitted with trays to take weights for deep tillage work. Each gang of disks is independently adjustable, and there are spring steel scrapers on all 24 disks. The whole assembly is suitable for attachment to category 1 or category 2 tractor hydraulic lift. The makers are Martin's Cultivator Co. Ltd.

Ditching Made Easy

The ' Becfab ' ditcher-dyker is a useful machine for the draining of low meadow and making marsh waterways and plantation main drains. It leaves the banks in perfect condition at a sound angle and it will scour the narrowest ditch to a depth of 6 ft. with the Mk. 1 machine or 8 ft. with the Mk. 2 machine. Both models have identical controls and can be operated by one man, working alone.



One of the new Bray tractor shovels in use. The BL450T has a lifting capacity of 3,100 lb.

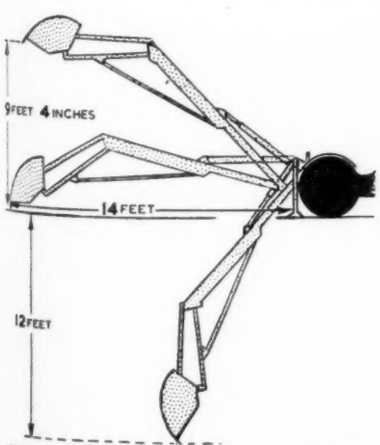
The jib is an electrically-welded lattice, which is mounted under the rear end of the tractor to which it is attached. No alterations are necessary to the tractor and the whole assembly can be fitted in 15 min. The bucket width is the same in both models – 2 ft. 11 in.; the length of the jib from the pivot point beneath the rear axle to the cutting edge of the bucket is 11 ft. 6 in. for the Mk. 1 model and 13 ft. 3 in. for the Mk. 2 model.

The rate of work is from 10 to 18 chains per hour, and the amount of spoil which can be removed in an hour ranges from 171 to 634 cu. ft. per hour, depending on the conditions of the test. The bucket is operated hydraulically by a simple scooping and forward-discharging operation. Where extra ground adhesion is required, special tractor wheel extensions can be supplied.

A Versatile Implement

The 'Shawnee Scout' Mk. 2 is a hydraulic digger for operation through the p.t.-o. of a tractor and with full hydraulic control of all its manoeuvres. It consists essentially of a powerful hinged bucket, working on a folding arm, having a reach of 14 ft. and a lift of 9 ft. 4 in., and permitting straight down digging to a depth of 12 ft., with truck loading of the spoil. The digger may also be swung through an arc of 105°.

It can thus be used for a variety of operations, such as deep-digging with high loading of the excavated soil into a lorry, continuous trench or drain digging, excavating irrigation channels and ordinary earth-moving operations.



The 'Shawnee Scout' Mk. 2 hydraulic digger has a reach that can dig down to 12 ft. and raise the spoil to a height of 9 ft. 4 in. for loading into lorries

The machine is so sturdy and tough that the makers claim it can dig through hard frozen ground and work under the most difficult conditions. It is very easily hitched to the rear of the tractor and the main thrust is taken not by the tractor, but by the ground through a very sturdy stabilising frame.

A Powerful Excavator

A continuous slew and digging action through an arc of 190°, with a reach of 18 ft., a loading height of 12 ft. 6 in., and excavation to a depth of 14 ft., with a range of buckets from 10 in. to 54 in., are features of the 'Dinkum Digger Major', the latest production of Whitlock Bros. Ltd.

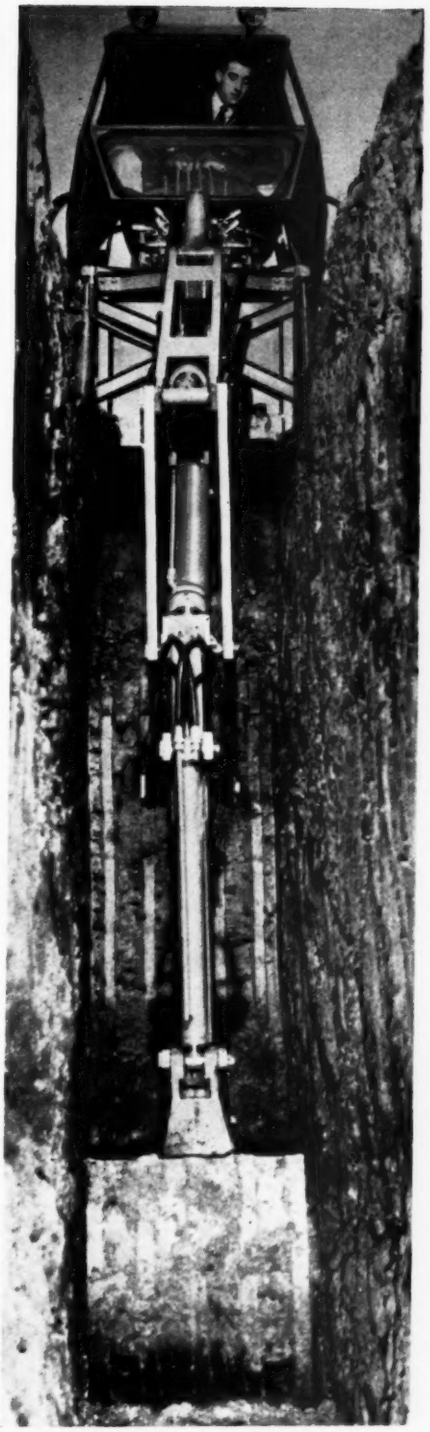
An hydraulic system of advanced design incorporates a slow-running pump driven from the p.t.-o. shaft; the oil system is fan-cooled and is fitted with full-flow micronic filters, strainers, air cleaner, magnetic plugs and dual relief valves.

All vulnerable high-pressure hoses have been drastically reduced to an average length of only 20 in. by building drawn-steel tubes into the main jib, and into the frame and slewing post, and these hoses are all tested to 6,000 lb./sq. in. A unique design of rotary valve is built into the slewing post. As this has swivel-bearing couplings it also protects the power hose lines from all stresses and strains.

The machine is rigidly mounted on a specially built Fordson diesel power unit.

The operator has an adjustable upholstered seat in an all-weather cabin, the rear window of which is hinged to open right down; the side windows slide and the roof may be removed in a matter of seconds.

A new implement introduced with this excavator is a power shovel of 3–4 cu. yd. capacity, which will strip, dig and load as well as bulldoze; it is also fully capable of tackling all site work, including deep trenching and mass excavations.



The 'Dinkum Digger Major' can excavate to a depth of 14 ft. as well as slew through an arc of 190°

Tilting the Blade

A new hydraulic cylinder attachment for tilting Caterpillar No. 7S bulldozers controlled by No. 25 cable controls has been announced by Caterpillar Tractor Co. Ltd. It replaces the bulldozer blade's left tilt brace and provides 'in-the-seat' blade tilting. This now makes it unnecessary for the operator to dismount in order to tilt the blade, which often accounted for the blade being worked horizontally on many jobs calling for blade tilting.

This new hydraulic attachment makes the Caterpillar D7 tractor and No. 7S bulldozer especially suited for pioneering roads on hillsides, making drains, dozing slopes, digging rocks,

removing stumps and other applications requiring frequent blade tilting.

Clearing Cover

The shredding of stalks and the comminution of a vegetable cover ensures clean ploughing and the effective return of valuable organic matter to the soil; it hastens rotting and prevents run-off and erosion by making the soil more absorbent. The ' Horndraulic ' shredder is a mechanical implement which can be used to chop up and level non-woody vegetation, such as bramble, bracken and heather, or a nitrogenous cover crop, and it has actually been used to knock down the following crop residues: maize, wheat, oats, barley and soya-bean, field weeds, potato vines, sugar-beet tops. Its use for the reduction of the ratoon plants in an old pineapple field, prior to ploughing them in, would appear to be a further application, as also the cleaning up of paddy fields.

The ' Horndraulic ' shredder, manufactured by Steel Fabricators Ltd., makes a clean blanket sweep of the covering vegetation, shredding and levelling stalks and weeds, and it thus prepares the ground for ploughing and cultivation, without any further cleaning up being necessary.

The machine is attached to the rear linkage of the tractor and is operated through the p.t.-o. The centre shaft is driven at direct tractor speed and through a system of gears operates three beater heads, rotating them at right angles to the direction of travel. The hammers of the three rotors of the unit make 287 hits per second at normal tractor speed. For safety, the power-shaft and the rotors are hooded, and the low shields on the sides and baffle plates in the hood guard against windrowing and deflect any large pieces of vegetation back into the cutting heads for further reduction.

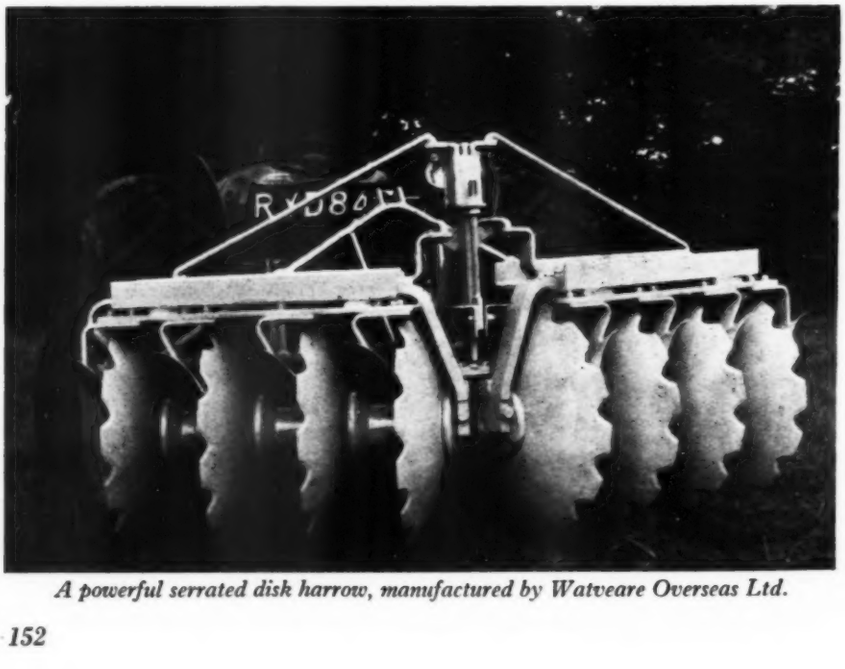
An illustration of the 'Horndraulic' shredder in action appears on p. 139.

Earth-moving

Market gardeners, farmers, plantation managers and colonising officers, with occasional earth-moving problems, will be interested in the 1-ton dumper attachment – the ' Tip Skip ' – manufactured by Bates Bros. Ltd., which can be fitted to any of the leading makes of tractor. A self-propelled dumper of the same capacity would cost seven times as much.

A self-propelled diesel dumper with a capacity of 1 cu. yd.

For large colonisation schemes, for levelling sports fields and for problems of large-scale earth-moving, this firm also offers a self-propelled 1 cu. yd. diesel dumper, a 4 cu. yd. dump-truck, and the ' Dumpmaster ' side-tipper, several of which can be towed by one driver. The ' Dumpmaster ' is a tipping truck which is gravity discharging and self-righting after discharge, and is released by means of a simple ratchet lever. It would appear to be eminently suitable for making protecting embankments, paddy field bunds, contour ridges and terrace roads, and also for other earth-moving and filling operations.



A powerful serrated disk harrow, manufactured by Watveare Overseas Ltd.

The ' Mudmaster ' detachable track can be fitted in 10 minutes to farm vehicles for work under very difficult conditions

Master of Mud

The ' Mudmaster ' detachable track can be fitted in 10 min. to the rear or driving wheels of light or heavy farm vehicles – cars, jeeps, estate vans, lorries, soil dumpers or heavy lorries – and will make it possible to drive the vehicle or to tow trailers through axle-deep mud, snow, tussock grass, bogland or over ploughed fields. The attachment is offered by Bates Bros. Ltd. in 11 different sizes for any type of car or light vehicle tyre and in 12 sizes for the wheels of heavy commercial vehicles or agricultural tractors.

For Bush and Moorland

Watveare Overseas Ltd. have evolved a powerful bush and bog harrow, which has been specially designed for the reclamation and initial preparation of moorland and bush prior to the preparation of land for planting. It could also be used for knocking down crop residues, such as a field of old pineapple plants, after the second ratoon fruit has been harvested. The machine has been severely tested under appalling conditions in Malaya.

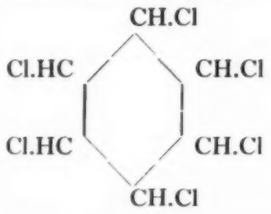
Agricultural Chemicals

Killing cleavers; keeping clovers; sterilant; defoliant; fungicide; insecticides; and grass fertiliser

Locust Control

BHC is a modern insecticide which was first synthesised by Faraday in 1825, though its value as an insecticide was discovered only in 1940. A complete range of BHC formulations is now manufactured by the Standardised Disinfectants Co. Ltd. and sold under the 'Hexastan' trade mark.

BHC is the coined or common name for the chemical substance benzene hexachloride, 1:2:3:4:5:6 hexachloro *cyclo* hexane, which can be estimated by infra-red spectrometry or partition chromotography:



The gamma isomer is a powerful insecticide operating as a contact and stomach poison, and it is about ten times more toxic to insects than DDT but is less persistent. It is quick acting although it does not possess the outstanding 'knock down' properties of the pyrethrins.

'Hexastan 20', which contains 20% gamma BHC, is particularly suitable for the control of flies, mosquitoes, sandflies, midges, ticks, lice and fleas in labour lines, estate bungalows, farmyards, stables, showgrounds, jungle verges, sea beaches and other infested areas, and is best used as a fog formulation, containing 1% gamma BHC. For the control of pests in empty godowns and ships' holds, this product is best used as a 0.5% formulation.

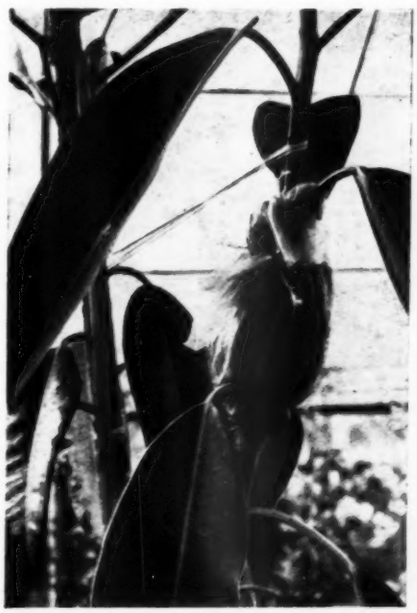
BHC has also proved to be very effective against locusts. The rate of application depends on the species, stage of life cycle and the terrain. 'Hexastan 20' diluted 1:9 with diesel oil is recommended for aerial spraying and it is also recommended for making poison baits.

In 15 years of extensive use, it has proved to be one of the safest insecticides to man, but it needs to be used carefully near water as it is toxic to fish. The use of BHC near flowers in the pollinating season should also be avoided, so as not to kill bees.

No Toxic Residues

There has been some concern recently about the residues of toxic pesticides left on food crops sprayed about the time of harvest and just before sale to consumers. Nevertheless, insect problems on ripening crops can be serious and crop losses may be considerable.

A new insecticide, Shell 'Phosdrin', meets the demand for a systemic material which will not only control aphis and caterpillar but also can be applied to a crop up to as little as three days before marketing, since it breaks down rapidly into harmless non-toxic and non-tainting components soon after application, and the crop can then be consumed with safety. This new insecticide gives a rapid and high kill of both aphis and caterpillar on fruit and ground crops. It kills by contact, fumigant and systemic action, is economic, rapid and efficient in its results and may be applied at any time, using either high- or low-volume spraying equipment.



Film made from bakelite polyethylene being used for rooting cuttings

Soil Sterilisation

Chemical sterilisation is cheaper and quicker than steaming, and does not affect the soil structure. Murphy Formaldehyde is effective against fungus diseases.

It is a solution containing approximately 38% formaldehyde, with good penetrating and wetting powers – an important consideration with heavy soils. It controls fungus diseases such as 'damping off', Verticillium Wilt, Fusarium Wilt and Root Rots caused by *Phytophthora* and *Rhizoctonia*, and in addition many harmful bacteria. It can be used for sterilising glasshouse soil, potting soil, casing soil for mushrooms, and pots, boxes, etc., for washing down glasshouses and mushroom houses, and for preventing Grey Mould (Botrytis) of lettuces and 'damping off' of mustard and cress.

★

For Rooting Cuttings

Film made from Bakelite polyethylene is useful for rooting cuttings before they are severed from the main plant. The selected cutting is enclosed in damp moss, which is then bandaged round with polyethylene film. This film acts as a moisture vapour barrier and so maintains the dampness of the moss until the roots have developed and the cutting is ready for severance.

★

Weed Control in Clovers

Wherever the first consideration in spraying is the safety of clovers, especially of white clover, whether in undersown crops, new or old leys, or in established pasture, it is obviously essential to use a selective weedkiller which does not damage seedling clovers. 'Buterex' is an active formulation of MCPB, which is recommended by Bayer Agriculture Ltd. for this purpose. Cereals sown alone can also be sprayed with this material at an earlier stage than with other materials, and it can also be used to control weeds in many varieties of peas.

This new formulation can be applied

at low volume through any good type of sprayer as it does not corrode the equipment; the spray is stated to be harmless to game and livestock.

The most complete 'kill' is obtained in fine weather when growth is rapid and the weeds are in their most vulnerable stage of growth. The following weeds are best treated in the seedling stage: field cabbage, charlock, nettle, orache, penny cress, shepherds purse, bindweed, chickweed, dock, fumitory, knotgrass, poppy, redshank, shepherds needle, sowthistle and speedwell. Thistles are best treated when 4 in. to 6 in. high, and corn buttercup when growth starts in the spring. Others are more susceptible just before flowering: creeping buttercup, crowfoot buttercup, plantain, bulbous buttercup and dandelion.

★

Defoliant for Cotton

'Meeno', a cotton defoliant, marketed by the American Chemical Paint Co., is a formulation of 3-amino-1, 2,4-triazole (amitrol; amizol). It is a powder which is readily soluble in water and is non-toxic to humans and animals at normal dilutions. It does not corrode spray equipment.

It is a very effective defoliant for cotton as it is absorbed and translocated within the cotton plant and systemically causes leaf drop. This also gives it the property of controlling regrowth. Results throughout the world indicate that second growth is retarded for from three to six weeks. This is an important factor in areas that have unsettled weather at crop-picking time.

★

Early Bite

Growing early-spring grass by applying a quick-acting nitrogen fertiliser is now a well-established practice on most dairy farms in Britain as it reduces winter feeding costs by saving about three weeks' supply of purchased concentrates. For this purpose ICI 'Nitro-Chalk' and sulphate of ammonia are used but to get the best response, phosphate, potash and lime need to be applied to the grassland during the winter in the form of basic slag, muriate of potash and ground limestone.

The nitrogen fertilisers are applied about four weeks before the earliest grazing – say late February or early March, according to district, and then to ensure continuity, other fields can be top-dressed with nitrogen. If not immediately required, these can be cut for silage.

The ideal fields for such early grass production are, of course, those in a sheltered position and facing south and any good pasture will do as long as it contains some early-growing species – the earliest grazing of all being given by Italian ryegrass. The allowance per cow is between one-third and one-half an acre.

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Control of Cleavers

Galium aparine constitutes a major weed problem of cereals. The spread of this obnoxious weed has been aggravated by the use of the combine-harvester and by the existing plant growth regulator herbicides which, whilst removing other weeds, have allowed cleavers to grow almost unhindered. Cleavers competes with the crop for soil nutrients, light and air. Dense infestations pull down the crop, often causing severe lodging with its attendant harvesting difficulties and loss of yield. The seeds are only removed with difficulty from some varieties of grain and thus its propagation is ensured.

For many years the Research Department of Boots Pure Drug Co. Ltd. has worked on new methods to control this weed. Several hundred compounds were produced and tested by the Agricultural and Horticuture Division before one which possessed high activity and crop safety was discovered. This was CMPP, alpha-(4-chloro-2-methylphenoxy) propionic acid, the active substance contained in 'Iso-Cornox', which is the trade name for the formulated product containing 32% w/v acid equivalent of the amine salt of this acid.

This product was first announced at the Weed Control Conference in 1956 and is now in full-scale production.

This product is non-poisonous and safe to the operator using it, and there is evidence to show that no residues in the grain are to be expected. It also has a wide margin of safety on cereal crops and is confidently recommended by the makers for use on the three major cereals, wheat, oats and barley. It is stated that it safely and effectively controls cleavers and a range of other weeds provided that it is applied within certain limits in the life history of the crop. It is also necessary that the weed should be growing actively, when sprayed.

An almost complete eradication is achieved by using Iso-Cornox at the recommended rate of only 6 pints per acre. In order to ensure penetration of the spray through well-tillered winter crops, in which cleavers is so frequently found, a minimum of 20 gall. of water per acre is recommended. It is easy to mix in the sprayer tank and presents no problems with normal hard waters.

★

For the Greenhouse

For the prevention and treatment of Botrytis and mildew infections on tomatoes, lettuce and chrysanthemums, growing in medium-sized greenhouses, Waeco Ltd. have now introduced an intermediate size of 'Fumite' fungicidal smoke generator. Based on TCNB, one generator evolves 8¼ g. of tecnazene, when active.

It is offered as 'Fumite' TCNB, size 3, in conveniently small cylindrical generators. Where plants are seriously infected, one such generator will give effective coverage to 1,500 cu. ft.; in the early stages of infection, the effective coverage is 2,250 cu. ft.; and as a preventive measure, before there are any signs of infection, one generator will give protection to 3,000 cu. ft.

★

'Embutox'

This product is a safe formulation for the control of weeds in seedling lucerne and white clover. It contains 2,4-DB, which is 4-(2,4-dichlorophenoxy) butyric acid; it does *not* contain 2,4-D, which is 2,4-dichlorophenoxyacetic acid, as stated incorrectly in our review of the exhibits of May and Baker Ltd. at the Smithfield Show, WORLD CROPS, 1958, **10**, 32.

World Crop Reports

INTERNATIONAL REPORTS

Groundnuts

World production of groundnuts in 1957 *is forecast at an all-time record of* 14.4 *million short tons, unshelled basis.* This represents an increase of 4% from the previous record outturn of 1956 and an increase of 25% from the 1950–54 average.

The estimated expansion of 550,000 tons from 1956 is attributed to record crops in three of the four major producing countries – India, French West Africa and Nigeria. In China, which ranks second to India as a groundnut producer, the 1957 crop is believed to have declined significantly.

A modest decline in *North American* groundnut production resulted from smaller crops in the U.S.A. and Mexico. Production in the U.S.A. is estimated at 752,000 tons, 6% less than in 1956. Acreage picked and threshed was 11% larger than last year, but dry weather in the growing season in some areas and late rains, excessive in some areas, reduced yields. Mexico's smaller crop is attributed to reduced acreage.

A slight decline in production is estimated for *Asia* because the gain foreseen in India only partially offsets the decrease that is believed to have occurred in China. In China, acreage is believed to have declined in the major producing areas and the weather is reported to have been unfavourable. Consequently, production is believed to have declined by possibly 15%. India's crop is estimated unofficially at a record 4.8 million tons, 5% larger than the near-record harvest of 1956.

Burma's groundnut production is up slightly from 1956. The Government has encouraged an increase this year, especially since India has placed an embargo on exports of groundnut oil – an important item in the Burmese diet. Consequently, some land was used for groundnuts that might otherwise have been planted with tobacco.

Indonesia's 1957 groundnut production increased by one-fifth from 1956.

The *South American* groundnut crop increased by almost one-fifth from the previous year. Argentina's production at 350,000 tons was an all-time record; with good prices and high yields tending to make this crop popular, acreage now being planted for the 1957–58 crop is expected to be the largest on record. Brazil's crop was 13% less than last year.

Production in *Africa* will be up sharply this year if present favourable prospects in French West Africa and Nigeria materialise. In French West Africa total production may reach 1.6 million tons, almost one-fifth larger than last year's record. Every available means has been used to increase acreage and production. The weather in Nigeria has been exceptionally favourable and a bumper crop is predicted. Total production is forecast at almost 1.4 million tons (in-shell basis) compared with 875,000 tons in 1956, and the quality is improving.

In the Union of South Africa 1957 production is about one-fifth less than in 1956.

Jute

World production of jute in 1957 is estimated at about 4,518 million lb., compared with 4,569 million lb. in 1956 and a pre-war average of 3,422 million lb. The output is expected to be adequate for world needs in 1958. Crop increases are reported in *India, Taiwan, Japan,* and most minor producing countries. The decrease, however, of 80 million lb. in *Pakistan* (the largest producer) together with small crop decreases in *Brazil* and *Iran,* brings the world total to about 51 million lb. less than in the preceding year.

Pakistan produced 58% of the current jute crop, India 38% and Brazil 1.5%. Pakistan and India together have increased production over the pre-war average by about 1,000 million lb. or 30%. The Brazilian crop of 66 million lb. in 1957 shows the rapid growth of production in that country from the pre-war average of 113,000 lb.

REGIONAL REPORTS

Rhodesia

The 1957 *maize* crop in Northern Rhodesia was the largest ever recorded; it amounted to 2,075,000 bags, each weighing 200 lb. About 51% was produced on European farms and the remainder grown by African farmers. Maize consumption within the Territory remains fairly steady at 1,135,000 bags a year and allowing for stocks at the beginning of the year and a reserve of six months' supply, this will leave about 800,000 bags for export.

The first crop of wheat has been harvested on a pilot irrigation scheme on the Kafue Flats. An average of 5½ bags of grain per acre was the yield obtained from an area of 88 acres. The experiment is still in its early stages but the success of the first wheat crop gives cause for considerable optimism and it is hoped that in time the Kafue Flats can be turned into a large-scale irrigation farming area on the Dutch pattern and become the granary of Central Africa.

In Southern Rhodesia the 1958 crop position improved as a result of plentiful rain at the beginning of January but prolonged wet conditions more recently and low soil temperatures may offset the initial benefit. Good maize crops are expected in some areas but in many others the crop is beginning to tassel.

Tobacco has also benefited from the rain and prospects are promising. The eastern districts have produced good crops of sweet corn, beans, vegetables, potatoes and green manure and the canning factories are receiving satisfactory deliveries.

Canary Islands

The extent of the damage caused by the wind storm on the north of Teneriffe and at Arucas in Grand Canary in December has been estimated at about 25,000 tons of *bananas* lost. This is some 10% of the total annual production of the Canary Islands. In terms of sterling the loss can be calculated at some £1,150,000. The cumulative effect of this damage to trees will be considerable but as there is a constant extension of banana plantations, as and when more water is made available by borings into the mountain sides, the normal annual exports should be maintained in 1958.

Total exports of *tomatoes* during the last quarter of 1957 amounted to some 2,760,000 baskets (6 kg. net), of which some 2,380,000 baskets were shipped to the U.K. In the corresponding

removing stumps and other applications requiring frequent blade tilting.

Clearing Cover

The shredding of stalks and the comminution of a vegetable cover ensures clean ploughing and the effective return of valuable organic matter to the soil; it hastens rotting and prevents run-off and erosion by making the soil more absorbent. The ' Horndraulic ' shredder is a mechanical implement which can be used to chop up and level non-woody vegetation, such as bramble, bracken and heather, or a nitrogenous cover crop, and it has actually been used to knock down the following crop residues: maize, wheat, oats, barley and soya-bean, field weeds, potato vines, sugar-beet tops. Its use for the reduction of the ratoon plants in an old pineapple field, prior to ploughing them in, would appear to be a further application, as also the cleaning up of paddy fields.

The ' Horndraulic ' shredder, manufactured by Steel Fabricators Ltd., makes a clean blanket sweep of the covering vegetation, shredding and levelling stalks and weeds, and it thus prepares the ground for ploughing and cultivation, without any further cleaning up being necessary.

The machine is attached to the rear linkage of the tractor and is operated through the p.t.-o. The centre shaft is driven at direct tractor speed and through a system of gears operates three beater heads, rotating them at right angles to the direction of travel. The hammers of the three rotors of the unit make 287 hits per second at normal tractor speed. For safety, the power-shaft and the rotors are hooded, and the low shields on the sides and baffle plates in the hood guard against windrowing and deflect any large pieces of vegetation back into the cutting heads for further reduction.

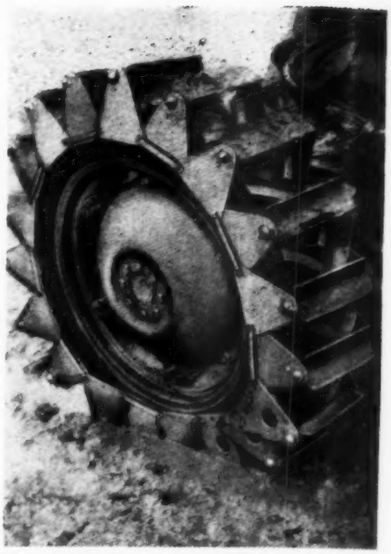
An illustration of the 'Horndraulic' shredder in action appears on p. 139.

Earth-moving

Market gardeners, farmers, plantation managers and colonising officers, with occasional earth-moving problems, will be interested in the 1-ton dumper attachment – the ' Tip Skip ' – manufactured by Bates Bros. Ltd., which can be fitted to any of the leading makes of tractor. A self-propelled dumper of the same capacity would cost seven times as much.

A self-propelled diesel dumper with a capacity of 1 cu. yd.

For large colonisation schemes, for levelling sports fields and for problems of large-scale earth-moving, this firm also offers a self-propelled 1 cu. yd. diesel dumper, a 4 cu. yd. dump-truck, and the ' Dumpmaster ' side-tipper, several of which can be towed by one driver. The ' Dumpmaster ' is a tipping truck which is gravity discharging and self-righting after discharge, and is released by means of a simple ratchet lever. It would appear to be eminently suitable for making protecting embankments, paddy field bunds, contour ridges and terrace roads, and also for other earth-moving and filling operations.



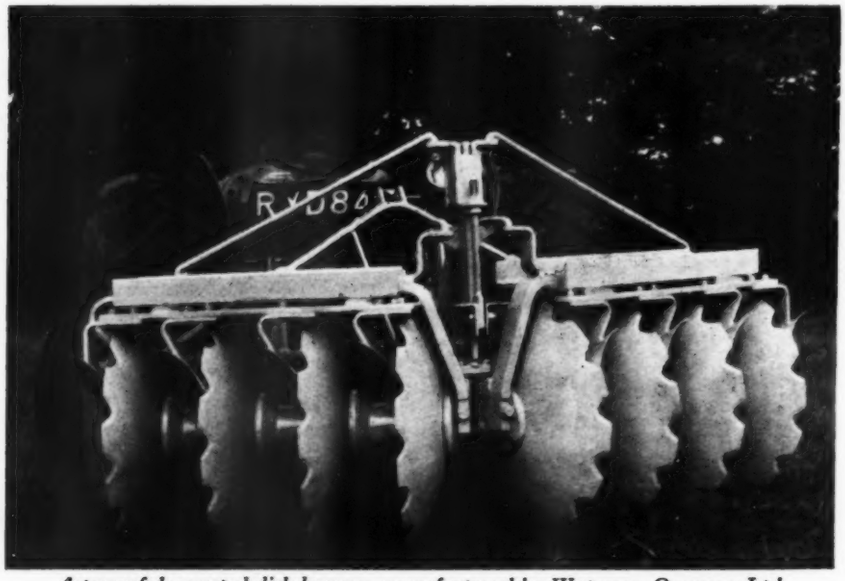
The ' Mudmaster ' detachable track can be fitted in 10 minutes to farm vehicles for work under very difficult conditions

Master of Mud

The ' Mudmaster ' detachable track can be fitted in 10 min. to the rear or driving wheels of light or heavy farm vehicles – cars, jeeps, estate vans, lorries, soil dumpers or heavy lorries – and will make it possible to drive the vehicle or to tow trailers through axle-deep mud, snow, tussock grass, bog-land or over ploughed fields. The attachment is offered by Bates Bros. Ltd. in 11 different sizes for any type of car or light vehicle tyre and in 12 sizes for the wheels of heavy commercial vehicles or agricultural tractors.

For Bush and Moorland

Watveare Overseas Ltd. have evolved a powerful bush and bog harrow, which has been specially designed for the reclamation and initial preparation of moorland and bush prior to the preparation of land for planting. It could also be used for knocking down crop residues, such as a field of old pine-apple plants, after the second ratoon fruit has been harvested. The machine has been severely tested under appalling conditions in Malaya.



A powerful serrated disk harrow, manufactured by Watveare Overseas Ltd.

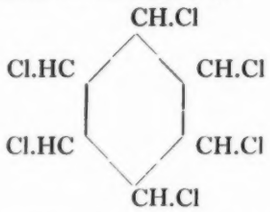
Agricultural Chemicals

Killing cleavers; keeping clovers; sterilant; defoliant; fungicide; insecticides; and grass fertiliser

Locust Control

BHC is a modern insecticide which was first synthesised by Faraday in 1825, though its value as an insecticide was discovered only in 1940. A complete range of BHC formulations is now manufactured by the Standardised Disinfectants Co. Ltd. and sold under the ' Hexastan ' trade mark.

BHC is the coined or common name for the chemical substance benzene hexachloride, 1:2:3:4:5:6 hexachloro *cyclo* hexane, which can be estimated by infra-red spectrometry or partition chromotography:



The gamma isomer is a powerful insecticide operating as a contact and stomach poison, and it is about ten times more toxic to insects than DDT but is less persistent. It is quick acting although it does not possess the outstanding ' knock down ' properties of the pyrethrins.

' Hexastan 20 ', which contains 20% gamma BHC, is particularly suitable for the control of flies, mosquitoes, sandflies, midges, ticks, lice and fleas in labour lines, estate bungalows, farmyards, stables, showgrounds, jungle verges, sea beaches and other infested areas, and is best used as a fog formulation, containing 1% gamma BHC. For the control of pests in empty godowns and ships' holds, this product is best used as a 0.5% formulation.

BHC has also proved to be very effective against locusts. The rate of application depends on the species, stage of life cycle and the terrain. 'Hexastan 20' diluted 1:9 with diesel oil is recommended for aerial spraying and it is also recommended for making poison baits.

In 15 years of extensive use, it has proved to be one of the safest insecticides to man, but it needs to be used carefully near water as it is toxic to fish. The use of BHC near flowers in the pollinating season should also be avoided, so as not to kill bees.

No Toxic Residues

There has been some concern recently about the residues of toxic pesticides left on food crops sprayed about the time of harvest and just before sale to consumers. Nevertheless, insect problems on ripening crops can be serious and crop losses may be considerable.

A new insecticide, Shell ' Phosdrin ', meets the demand for a systemic material which will not only control aphis and caterpillar but also can be applied to a crop up to as little as three days before marketing, since it breaks down rapidly into harmless non-toxic and non-tainting components soon after application, and the crop can then be consumed with safety. This new insecticide gives a rapid and high kill of both aphis and caterpillar on fruit and ground crops. It kills by contact, fumigant and systemic action, is economic, rapid and efficient in its results and may be applied at any time, using either high- or low-volume spraying equipment.

Film made from bakelite polyethylene being used for rooting cuttings

Soil Sterilisation

Chemical sterilisation is cheaper and quicker than steaming, and does not affect the soil structure. Murphy Formaldehyde is effective against fungus diseases.

It is a solution containing approximately 38% formaldehyde, with good penetrating and wetting powers – an important consideration with heavy soils. It controls fungus diseases such as ' damping off ', Verticillium Wilt, Fusarium Wilt and Root Rots caused by *Phytophthora* and *Rhizoctonia*, and in addition many harmful bacteria. It can be used for sterilising glasshouse soil, potting soil, casing soil for mushrooms, and pots, boxes, etc., for washing down glasshouses and mushroom houses, and for preventing Grey Mould (Botrytis) of lettuces and ' damping off ' of mustard and cress.

★

For Rooting Cuttings

Film made from Bakelite polyethylene is useful for rooting cuttings before they are severed from the main plant. The selected cutting is enclosed in damp moss, which is then bandaged round with polyethylene film. This film acts as a moisture vapour barrier and so maintains the dampness of the moss until the roots have developed and the cutting is ready for severance.

★

Weed Control in Clovers

Wherever the first consideration in spraying is the safety of clovers, especially of white clover, whether in undersown crops, new or old leys, or in established pasture, it is obviously essential to use a selective weedkiller which does not damage seedling clovers. ' Buterex ' is an active formulation of MCPB, which is recommended by Bayer Agriculture Ltd. for this purpose. Cereals sown alone can also be sprayed with this material at an earlier stage than with other materials, and it can also be used to control weeds in many varieties of peas.

This new formulation can be applied

at low volume through any good type of sprayer as it does not corrode the equipment; the spray is stated to be harmless to game and livestock.

The most complete 'kill' is obtained in fine weather when growth is rapid and the weeds are in their most vulnerable stage of growth. The following weeds are best treated in the seedling stage: field cabbage, charlock, nettle, orache, penny cress, shepherds purse, bindweed, chickweed, dock, fumitory, knotgrass, poppy, redshank, shepherds needle, sowthistle and speedwell. Thistles are best treated when 4 in. to 6 in. high, and corn buttercup when growth starts in the spring. Others are more susceptible just before flowering: creeping buttercup, crowfoot buttercup, plantain, bulbous buttercup and dandelion.

★

Defoliant for Cotton

'Meeno', a cotton defoliant, marketed by the American Chemical Paint Co., is a formulation of 3-amino-1, 2,4-triazole (amitrol; amizol). It is a powder which is readily soluble in water and is non-toxic to humans and animals at normal dilutions. It does not corrode spray equipment.

It is a very effective defoliant for cotton as it is absorbed and translocated within the cotton plant and systemically causes leaf drop. This also gives it the property of controlling regrowth. Results throughout the world indicate that second growth is retarded for from three to six weeks. This is an important factor in areas that have unsettled weather at crop-picking time.

★

Early Bite

Growing early-spring grass by applying a quick-acting nitrogen fertiliser is now a well-established practice on most dairy farms in Britain as it reduces winter feeding costs by saving about three weeks' supply of purchased concentrates. For this purpose ICI 'Nitro-Chalk' and sulphate of ammonia are used but to get the best response, phosphate, potash and lime need to be applied to the grassland during the winter in the form of basic slag, muriate of potash and ground limestone.

The nitrogen fertilisers are applied about four weeks before the earliest grazing – say late February or early March, according to district, and then to ensure continuity, other fields can be top-dressed with nitrogen. If not immediately required, these can be cut for silage.

The ideal fields for such early grass production are, of course, those in a sheltered position and facing south and any good pasture will do as long as it contains some early-growing species – the earliest grazing of all being given by Italian ryegrass. The allowance per cow is between one-third and one-half an acre.

Reader Service

For further information on any item reviewed in this issue please write to:

Reader Service
WORLD CROPS,
Leonard Hill House,
Eden Street, London N.W.1,
England

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Control of Cleavers

Galium aparine constitutes a major weed problem of cereals. The spread of this obnoxious weed has been aggravated by the use of the combine-harvester and by the existing plant growth regulator herbicides which, whilst removing other weeds, have allowed cleavers to grow almost unhindered. Cleavers competes with the crop for soil nutrients, light and air. Dense infestations pull down the crop, often causing severe lodging with its attendant harvesting difficulties and loss of yield. The seeds are only removed with difficulty from some varieties of grain and thus its propagation is ensured.

For many years the Research Department of Boots Pure Drug Co. Ltd. has worked on new methods to control this weed. Several hundred compounds were produced and tested by the Agricultural and Horticuture Division before one which possessed high activity and crop safety was discovered. This was CMPP, alpha-(4-chloro-2-methylphenoxy) propionic acid, the active substance contained in 'Iso-Cornox', which is the trade name for the formulated product containing 32% w/v acid equivalent of the amine salt of this acid.

This product was first announced at the Weed Control Conference in 1956 and is now in full-scale production.

This product is non-poisonous and safe to the operator using it, and there is evidence to show that no residues in the grain are to be expected. It also has a wide margin of safety on cereal crops and is confidently recommended by the makers for use on the three major cereals, wheat, oats and barley. It is stated that it safely and effectively controls cleavers and a range of other weeds provided that it is applied within certain limits in the life history of the crop. It is also necessary that the weed should be growing actively, when sprayed.

An almost complete eradication is achieved by using Iso-Cornox at the recommended rate of only 6 pints per acre. In order to ensure penetration of the spray through well-tillered winter crops, in which cleavers is so frequently found, a minimum of 20 gall. of water per acre is recommended. It is easy to mix in the sprayer tank and presents no problems with normal hard waters.

★

For the Greenhouse

For the prevention and treatment of Botrytis and mildew infections on tomatoes, lettuce and chrysanthemums, growing in medium-sized greenhouses, Waeco Ltd. have now introduced an intermediate size of 'Fumite' fungicidal smoke generator. Based on TCNB, one generator evolves 8¼ g. of tecnazene, when active.

It is offered as 'Fumite' TCNB, size 3, in conveniently small cylindrical generators. Where plants are seriously infected, one such generator will give effective coverage to 1,500 cu. ft.; in the early stages of infection, the effective coverage is 2,250 cu. ft.; and as a preventive measure, before there are any signs of infection, one generator will give protection to 3,000 cu. ft.

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'Embutox'

This product is a safe formulation for the control of weeds in seedling lucerne and white clover. It contains 2,4-DB, which is 4-(2,4-dichlorophenoxy) butyric acid; it does *not* contain 2,4-D, which is 2,4-dichlorophenoxyacetic acid, as stated incorrectly in our review of the exhibits of May and Baker Ltd. at the Smithfield Show, WORLD CROPS, 1958, **10**, 32.

World Crop Reports

INTERNATIONAL REPORTS

Groundnuts

World production of groundnuts in 1957 is forecast at an all-time record of 14.4 million short tons, unshelled basis. This represents an increase of 4% from the previous record outturn of 1956 and an increase of 25% from the 1950–54 average.

The estimated expansion of 550,000 tons from 1956 is attributed to record crops in three of the four major producing countries – India, French West Africa and Nigeria. In China, which ranks second to India as a groundnut producer, the 1957 crop is believed to have declined significantly.

A modest decline in *North American* groundnut production resulted from smaller crops in the U.S.A. and Mexico. Production in the U.S.A. is estimated at 752,000 tons, 6% less than in 1956. Acreage picked and threshed was 11% larger than last year, but dry weather in the growing season in some areas and late rains, excessive in some areas, reduced yields. Mexico's smaller crop is attributed to reduced acreage.

A slight decline in production is estimated for *Asia* because the gain foreseen in India only partially offsets the decrease that is believed to have occurred in China. In China, acreage is believed to have declined in the major producing areas and the weather is reported to have been unfavourable. Consequently, production is believed to have declined by possibly 15%. India's crop is estimated unofficially at a record 4.8 million tons, 5% larger than the near-record harvest of 1956.

Burma's groundnut production is up slightly from 1956. The Government has encouraged an increase this year, especially since India has placed an embargo on exports of groundnut oil – an important item in the Burmese diet. Consequently, some land was used for groundnuts that might otherwise have been planted with tobacco.

Indonesia's 1957 groundnut production increased by one-fifth from 1956.

The *South American* groundnut crop increased by almost one-fifth from the previous year. Argentina's production at 350,000 tons was an all-time record; with good prices and high yields tending to make this crop popular, acreage now being planted for the 1957–58 crop is expected to be the largest on record. Brazil's crop was 13% less than last year.

Production in *Africa* will be up sharply this year if present favourable prospects in French West Africa and Nigeria materialise. In French West Africa total production may reach 1.6 million tons, almost one-fifth larger than last year's record. Every available means has been used to increase acreage and production. The weather in Nigeria has been exceptionally favourable and a bumper crop is predicted. Total production is forecast at almost 1.4 million tons (in-shell basis) compared with 875,000 tons in 1956, and the quality is improving.

In the Union of South Africa 1957 production is about one-fifth less than in 1956.

Jute

World production of jute in 1957 is estimated at about 4,518 million lb., compared with 4,569 million lb. in 1956 and a pre-war average of 3,422 million lb. The output is expected to be adequate for world needs in 1958. Crop increases are reported in *India*, *Taiwan*, *Japan*, and most minor producing countries. The decrease, however, of 80 million lb. in *Pakistan* (the largest producer) together with small crop decreases in *Brazil* and *Iran*, brings the world total to about 51 million lb. less than in the preceding year.

Pakistan produced 58% of the current jute crop, India 38% and Brazil 1.5%. Pakistan and India together have increased production over the pre-war average by about 1,000 million lb. or 30%. The Brazilian crop of 66 million lb. in 1957 shows the rapid growth of production in that country from the pre-war average of 113,000 lb.

REGIONAL REPORTS

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period of last year some 2,627,000 baskets went to the U.K. Weather conditions have been unfavourable this season, affecting the volume and quality of fruit. Continued rains have hindered normal plantings for the second and third crops and it is feared that large quantities of tomatoes will be retarded and will be available for shipment too late to avoid the protective customs duty in the U.K. to be applied in June.

Greece

The 1957 *sultana* crop is forecast at 55,000 short tons, the largest on record. The 1956 crop, also large, was estimated at 50,500 short tons. Average production (1950–54) was 41,700 tons.

The 1957 dried *currant* crop is forecast at 85,000 short tons. This is only slightly below the five-year average of 86,000 tons, but 16,000 tons less than the 101,000-ton 1956 harvest.

Yugoslavia

The 1957 harvest was excellent for all *grain* crops. The official annual estimates have not yet been published, but the Secretary for Agriculture has given the figure of 3 million metric tons as the probable yield for wheat and rye. Of this, rye probably accounts for about 250,000 tons. Later unofficial estimates put the wheat harvest at 2,950,000 tons or 200,000 tons more. The official figure for the 1956 harvest of wheat and rye was 1,875,000 tons, the 1930–39 average having been 2,360,000 tons for wheat and 211,000 tons for rye. Despite this increase over 1956, it is estimated that import requirements of wheat during 1957–8 should be about 1 million tons on the basis of the 3 million ton estimate for wheat and rye. This figure allows for some increase in consumption. During the last crop year, *i.e.* July 1956 to June 1957, some 1,016,000 tons were imported under the U.S. Surplus Agricultural Products programme. During the same period 464,000 tons were imported from the Soviet Union.

The maize crop is estimated at 4,600,000 tons, the highest since 1938 when the area under cultivation was larger (the 1930–39 average was 4,220,000 tons). The average yield for the whole of Yugoslavia has been put at 18.2 metric quintals (of 100 kg). per ha. For the first time for some years some maize, probably 300,000 tons in all, is available for export. 50,000 tons are due to be exported to the Soviet Union and $600,000 worth to Eastern Germany in 1958.

Ceylon

Production of *tea* in Ceylon during November 1957 amounted to 36.2 million lb., some 2¼ million lb. less than in the corresponding month last year. The quantity of tea produced in Ceylon during the first 11 months of 1957 was such that production in the whole year can hardly fail to be a record.

Exports of *desiccated coconut* in the first nine months of 1957 amounted to 35,933 tons, a decrease of 16% from the corresponding period of 1956.

Syria

The 1957 *cotton* harvest is expected to amount to 110,000 tons from a planted area of 258,000 ha., of which 187,000 are irrigated and 71,000 are not irrigated. The 1956 yield was 93,000 tons from 273,000 ha. (of which 196,000 ha. were irrigated). The quality Palmyra Syrian, which has a fibre 0.5 in. long and is similar in strength and staple to the quality Karnak Egyptian, is expected to make its appearance in 1958 when about 3,000 tons will be produced in the Homs area.

Jamaica

The revised estimate issued by the Sugar Manufacturers' Association for the 1957 *sugar* crop is 359,786 tons. The 1958 crop is estimated at 387,000 tons.

The drought in some of the important *banana* growing areas during August is blamed for a decline in weekly shipments compared with those made earlier in the summer. Financial assistance is being given to growers in the areas stricken by the drought, which is said to have affected some 11,200 acres.

The possibility of topping last year's production of 110,000 boxes of *coffee* is more than likely, although the present severe dry season has scorched a fair percentage of the fruits.

So far the *pimento* crop has been disappointing due to the severe blight encountered earlier in the season. Supplies are not abundant.

Given a good season, expectations are that the autumn *cocoa* crop will be a good one.

Supplies of *kolanuts* have been good and the crop is considered to be bigger than last year's. There is an obvious improvement in the curing by growers.

It is reported that concern is being shown over the present production levels in the *citrus* industry, which, it is stated, have fallen during the last six years. Arrangements have been made for two experts to be sent by the British Government next year to investigate this decline and give technical advice on the proper establishment of the industry.

England and Wales

The estimated quantity of silage made in 1957 is about one-quarter of a million tons – 10% above the 1956 figure and nearly double that of five years ago.

Wheat acreage sown up to December 4, 1957, was 1½ million acres, about the same as for 1955, and some 15% above the 1956 figure.

Conditions generally during January 1958 were not favourable for cultivation, but some progress was made in most areas during the month. On the whole, the work was well forward for the time of year due to the good progress made previously. Satisfactory progress was made with field work.

Autumn-sown crops.—Wheat is generally strong and healthy; some slug damage is reported, mainly in Eastern areas. The small area of *barley* looks well. *Oats* are strong and healthy. *Rye* is a satisfactory crop. *Beans* are making good progress and no serious frost damage is reported.

There has been a variable amount of deterioration in *potatoes*, due to blight, but on the whole tubers are keeping well in clamps and stores.

Stocks of *winter keep* were not largely drawn on until the colder weather in the middle of the month. There are local shortages in some upland areas but elsewhere, unless exceptionally bad weather is experienced, supplies remaining should prove sufficient.

Acknowledgment is made to *For. Crops & Mark.* and to *Spec. Reg. Inform. Services* for much of the information contained in the above reports.

The item on England and Wales is abstracted from reports from the Ministry of Agriculture, Fisheries and Food.